Examining socioeconomic differences in mental health treatment utilization: The role of verbal intelligence and psychopathology

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Tiivistelmä/Referat – Abstract

Tavoitteet: Kaikki mielenterveysongelmista kärsivät eivät saa tarvitsemaansa hoitoa, mikä on kansainvälisesti tunnistettu ongelma. Tästä syystä on tärkeää tutkia hoidon käyttöön liittyviä tekijöitä. Tämän tutkimuksen tarkoituksena on tarkastella miten kielellinen kyvykkyys ja transdiagnostinen psykopatologia ovat yhteydessä mielenterveyspalveluiden käyttöön ja välittääkö sosioekonominen asema näitä vaikutuksia.

Menetelmät: Tutkimuksessa käytetiin laajaa englantilaista, väestöpohjaista poikittaisaineistoa The Adult Psychiatric Morbidity – kyselytutkimusta vuodelta 2007 (APMS 2007). Otokseen kuului 4,706 osallistujaa (joista 56% naisia). Psykopatologian rakennetta tutkittiin erillisten konfirmatorisen faktorianalyysin avulla. Kielellisen kyvykkyyden, psykopatologian ja sosioekonomisen aseman vaikutusta mielenterveyspalveluiden käyttöön tutkittiin rakenneyhtälömallinnuksella. Puuttuvia havaintoja korjattiin moni-imputoinnin avulla ja edellä mainitut analyysit tehtiin myös imputoidulla aineistolla (n= 7,403).

Tulokset ja johtopäätökset: Tulokset osoittivat, että psykopatologiaa voidaan mallintaa kahden transdiagnostisen faktorin, internalisaation ja eksternalisaation avulla. Psykopatologia, erityisesti internalisaatio, vaikuttaa parhaiten ennustavan mielenterveyspalveluiden käyttöä. Tämä tukee transdiagnostisen lähestymistavan hyödyllisyyttä kun tarkastellaan hoitoon haketumista ja laajemmin mielenterveysongelmien hoitoa.

Avainsanat – Nyckelord – Keywords
mielenterveyspalvelut, mielenterveys, transdiagnostinen psykopatologia, sosioekonominen asema, älykkyys

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Tiivistelmä/Referat – Abstract

Objectives: The unmet need in treatment utilization is a major public issue and therefore it is important to study factors associated with it. This study examines how intelligence, more specifically verbal intelligence, and transdiagnostic psychopathology are associated with treatment utilization and does socioeconomic status mediate these associations.

Methods: The current study utilizes a vast cross-sectional data The Adult Psychiatric Morbidity Survey 2007 (APMS 2007). The study sample included 4,707 participants (56% women). The structure of psychopathology was first examined with series of confirmatory factor analysis (CFA). The associations of verbal IQ, psychopathology and socioeconomic status to treatment utilization were examined with series of structural equation models (SEM). Multiple imputation procedures were conducted to correct for any possible bias resulting from missing values and the abovementioned analyses were rerun with the imputed data (n=7,403).

Results and Conclusions: The results showed comorbidity of mental disorders can be modelled with two latent transdiagnostic factors, namely internalization and externalization. Psychopathology, especially internalization, seems to be the best predictor of treatment utilization. This notion emphasizes the utility of transdiagnostic approach in examining those who seek treatment and further their utility in the context of mental health care.

Avainsanat – Nyckelord – Keywords
treatment utilization, mental health, comorbidity, transdiagnostic psychopathology, intelligence, socioeconomic status

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1. Introduction

Consistent finding in treatment utilization is that most of those suffering from mental disorders do not receive treatment (Demyttenaere et al., 2004; Kessler et al., 2005c; Sareen et al. 2007; Wang et al. 2005a; 2005b). This is a serious public issue and therefore it is important to examine factors related to treatment utilization. Comorbidity, i.e. co-occurrence of mental disorders, and severity of psychopathology have been shown to be related to treatment utilization (e.g. Andrews et al., 2001; Bebbington, et al., 2000a; 2000b; Bijl et al., 2003; Demyttenaere et al., 2004; Jacobi et al., 2004; Kessler et al., 2003; 2005c; Mojtabai et al., 2002; ten Have et al., 2004; Wang et al. 2000; 2007; Wittchen & Jacobi, 2005). Differences in socioeconomic status (later denoted SES) have been shown to affect treatment utilization (e.g. Wang et al., 2005b; 2007) but the evidence about the nature of these is sparse and thus warranting more research. One overlooked aspect in SES and treatment utilization is the underlying role of intelligence (later denoted IQ). This study examines how IQ, more specifically verbal IQ, and psychopathology are associated with treatment utilization and whether socioeconomic status mediates these associations in a representative sample from England.

1.1. Treatment utilization

In treatment utilization there is a treatment gap meaning that many of the individuals in need for mental health treatment do not receive it (Demyttenaere et al., 2004; Kessler et al., 2005c; Kohn, Saxena, Levav, & Saraceno, 2004; Sareen et al. 2007; Wang et al. 2005a; 2005b; Wittchen & Jacobi, 2005; Wittchen et al., 2011). The treatment gap is high regardless of the highly disabling nature of mental illnesses (e.g. Bebbington, et al., 2000a; Demyttenaere et al., 2004; Kessler et al., 2001; Kohn et al., 2004; Wittchen, & Jacobi, 2005; Wittchen et al., 2011). The unmet need is pervasive (Wang et al., 2007) and according to some estimates, it affects 35.5% to 50.3% of those seriously ill in developed countries (Demyttenaere et al., 2004) and in Europe approximately 48% (Alonso et al, 2007). The substantial amount of untreated mental health disorders, and the disability associated with it, is an important public issue. Therefore, it is important to examine the factors related to treatment utilization, especially to utilization of adequate treatment by psychotherapy and medication.

How mental health treatment is organized varies across countries (e.g. Jacob et al., 2007, Thornicroft & Tansella, 2004) and the estimates of treatment utilization rates vary by the service used (Bebbington et al., 2000b; Wang et al., 2000; 2005b; Wittchen & Jacobi, 2005; Wittchen et al.,

2011). According to National Health Services (NHS, 2016) in England, mental health services are organized to primary and secondary care services. Initiating treatment starts usually with consultation with a general practitioner (GP) who then refers to further treatment (e.g. Bebbington et al. 2000b; NHS). In UK only one-third from individuals suffering from a neurotic disorder were reported to contact their GP for mental health reasons (Bebbington et al., 2000b). Among the individual suffering from neurotic dirorders one third were receiving treatment with 8% receiving medical treatment and 9 % counselling or psychotherapy (Bebbington et al., 2000b). Somewhat similar estimates have been reported across Europe (see Wittchen & Jacobi, 2005; Wittchen et al., 2011) with approximately one out of two individuals with a mental disorder having had any professional care and of those, a vast majority having only visited primary care (Wittchen et al., 2011). Professional mental health care receives around every fourth person in Europe (Wittchen et al., 2011) with similar reports from WHO across the world (Andrade et al., 2014). Only around 10% is reported to have adequate treatment by psychoactive drugs and psychotherapy (Wittchen et al., 2011). Comparable percentages have been previously reported in United States, with about one-fourth to one-third of those treated having adequate treatment by psychoactive drugs or psychotherapy (Wang et al., 2000; 2005b).

1.2. Psychopathology and treatment utilization

Individual mental disorders differ in treatment utilization rates (e.g. Bender et al., 2001; Kohn et al., 2004; Mojtabai, Olfson, & Mechanic, 2002), but even more important factor in utilizing treatment seems to be disorder severity and comorbidity (e.g. Andrews et al., 2001; Bebbington, et al., 2000a; 2000b; Bijl et al., 2003; Demyttenaere et al., 2004; Jacobi et al., 2004; Kessler et al., 2003; 2005c; Mojtabai et al., 2002; ten Have et al., 2004; Wang et al. 2000; 2007; Wittchen & Jacobi, 2005). This leads to the question of how psychopathology should be examined especially in relation to treatment utilization. Traditionally, the dominant way of examining mental health has relied on the view of mental health issues as categorical, i.e. diagnoses. However, this diagnostic approach has gained a lot of criticism as it has been established that mental disorders consistently co-occur (Kessler, Chiu, Demler, & Walters, 2005b; Krueger & Markon, 2006; Weich, McBride, Hussey, Exeter, Brugha, & McManus, 2011) and that diagnoses are not very stable over time (Forrester, Owens, & Johnstone, 2001). More recently researchers have moved on to a new wave of dimensional, i.e. transdiagnostic, models of mental disorders.

One of the most plausible models is conseptualizing comorbidity of mental disorders with two latent latent factors, namely internalization and externalization (Achenbach & Edelbrock, 1978;

1984; Krueger et al., 1998; 1999). The internalizing factor is described by negative emotion and includes disorders such as depression and anxiety, phobias, dysthymia, panic, posttraumatic stress disorder (e.g. Carragher et al., 2015; Greene & Eaton, 2017; Keyes et al., 2012; 2013; Kim & Eaton, 2015; Kotov et al., 2011; Krueger & Markon, 2006; Markon, 2010) and eating disorders (Forbush et al., 2010; Forbush & Watson, 2013; Kotov et al., 2011; Mitchell, Wolf, Reardon, & Miller, 2014). Internalization factor has also been suggested to divide into two sub-factors, fear and distress (Greene & Eaton, 2017; Eaton et al., 2013; Keyes et al., 2013; Kim & Eaton, 2015; Krueger & Markon, 2006; Krueger, 1999; Lahey et al., 2012). The externalization factor on the other hand is characterized by disorders related to disinhibition and behavioral dysfunction such as antisocial personality and substance abuse, including alcohol, drugs, and nicotine (e.g. Forbes et al., 2016; Keyes et al., 2012; 2013; Krueger & Markon, 2006b; Lahey et al., 2012; Markon, 2010), and gambling (Carrager et al. 2015). The internalization and externalization factors have been replicated repeatedly with various measures, and across developmental stages and populations (e.g. for review see Forbes et al., 2016; Achenbach & Edelbrock, 1978; 1984; Kessler et al., 2011; Keyes et al., 2013; Kim & Eaton, 2015; Krueger et al., 1998; 1999; Krueger & Markon, 2006; Lahey et al., 2015; Markon, 2010; Patalay et al., 2015; Tackett et al., 2013; Waldman et al., 2016).

More recently, research has evolved towards bi-factor models by adding a general psychopathology factor to the internalization-externalization spectra. This general psychopathology factor has been named *p* factor as it parallels to the g factor in intelligence research (Caspi et al., 2014). The bi-factor model posits that psychopathology is best modelled with a general latent factor, capturing the shared variance among all the mental disorders, alongside with two additional unique and orthogonal latent variables, i.e. internalization and externalization (Hankin et al., 2016). The bi-factor structure has been found in many different populations, across developmental stages and with various measures (Carragher et al., 2016; Caspi et al., 2014; Kim & Eaton, 2015; Keyes et al., 2012; 2013; Kotov et al., 2011; Lahey et al., 2012; 2015; Laceulle, Bollebergh, & Ormel, 2015; Markon, 2010; Murray, Eisner, & Ribeaud, 2016; Olino et al., 2014; Patalay et al., 2015; Pettersson, Lahey, Larsson, Lundström, & Lichtenstein, 2015; Tackett et al., 2013; Waldman et al., 2016).

Both bi-factor (Castellanos-Ryan et al., 2016; Greene & Eaton, 2017; Murray, Eisner, & Ribeaud, 2016; Snyder, Young, & Hankin, 2017) and internalization and externalization (Eaton et al., 2013; Krueger et al., 1998) have been shown to be stable over time. Further, general factor have shown to be invariant across genders (Caspi et al., 2014; Patalay et al., 2015) while the evidence about the invariance of the specific factors is less consistent. Others have shown notable invarianse (Eaton et al., 2012; Hicks et al., 2007; Kramer, Krueger, & Hicks, 2008) while others have shown the specific

factors to be highly gendered (Caspi et al., 2014). Alongside the general factor, other specific factors have also been introduced to the model (e.g. see Murray, Eisner, & Ribeaud, 2016; Noordhof et al., 2015; Kotov et al., 2011), with the though factor, illustrated by psychosis, disordered thinking, and mania, being most prominent (e.g. Carragher et al., 2016; Keyes et al., 2013; Kotov et al., 2011; Markon, 2010).

These factors have shown to share risk factors, including genetic liability (Lahey, Van Hulle, Singh, Waldman, & Rathouz, 2011; Pettersson et al. 2013; Pettersson, Larsson, & Lichtenstein, 2016; Tackett et al., 2013; Waldman et al., 2016), familial psychopathology and harsh parenting (Caspi et al., 2014; Waldman et al., 2016), and adverse childhood events (Eaton et al., 2015). However, findings about environmental influences have not been consistent (e.g. Kendler et al., 2011), and these effects are likely to operate according to genetic predispositions (Forbes et al., 2016).

The bi-factor model have also been criticized: it has been argued that the structure is merely a measurement artefact and that there are alternative explanations or that the emerged positive manifold, i.e. positive correlation between the variables, results inevitable in the form of a general factor (Bonify, Lane, & Reise, 2017; van Bork, Epskamp, Rhemtulla, Borsboom, & van der Maas, 2017). Despite the critique, a large amount of evidence supports the usefulness of the dimensional view in examining mental health.

To my knowledge, only two studies have previously examined transdiagnostic factors in relation to treatment utilization. One study, focusing only on the internalizing factor, found it to be strongly related to treatment seeking for mental health reasons (Sunderland & Slade, 2015) while the other study showed both internalization and externalization factors to be related to all forms treatment utilization (Rodriguez-Seijas, Eaton, Stohl, Mauro, & Hasin, 2017). The study also showed that when internalization and externalization were examined together, externalization was associated with significantly decreased odds to utilize treatment for any emotional disorder (Rodriguez-Seijas et al., 2017). It was further found that the factors interacted in a way that externalization reduced the association between internalization and domain specific treatment, i.e. designed for emotional disorder, whereas higher internalization decreased the association between externalization and domain specific treatment, i.e designed for substance abuse (Rodriquez-Seijas et al., 2017). These findings suggest that applying transdiagnostic approach in treatment utilization research could be highly informative (Rodriquez-Seijas et al., 2017; Sunderland & Slade, 2015).

Research is also sparse in how these individual differences in transdiagnostic psychopathology are related to socioeconomic differences in treatment utilization. There is a social gradient in psychopathology meaning that those with lower SES have worse mental health (e.g. Fryers, Melzer, & Jenkins, 2003; Lorant et al., 2003) and further psychopathology has been associated with lower school attainment (Patalay et al., 2015; Pettersson et al., 2015), as well as lower school functioning, and intelligence (Caspi et al., 2014; Castellanos-Ryan et al., 2016; Lahey et al., 2015). Severity of psychopathology has also been associated with financial and treatment related structural barriers (Andrade et al., 2014; Mojtabai et al., 2011). Thus, individual differences in psychopathology and their relation to SES differences could partly explain the treatment gap.

1.3. The role of intelligence in socioeconomic differences and treatment utilization

Intelligence is often conceptualized as 'the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly, and learn from experience' (Gottfredson, 1997). IQ has been proposed to be the fundamental cause behind socioeconomic differences in health (Gottredson, 2004). Gottfredson (2004) argues that there are six main points supporting the notion that intelligence is the fundamental cause: IQ is measurable, has a general effect on health, has stable distribution over time, is replicable, is transportable form of influence and is falsifiable. Furthermore, intelligence is related to both SES (e.g. Neisser et al., 1996; Plomin & Deary, 2015; Strenze, 2007) and health (Whalley & Deary, 2001; Batty, Mortensen, & Osler, 2005; Deary & Der, 2005), which supports the notion of intelligence as the fundamental cause of the socioeconomic health differences. IQ predicts SES (Strenze, 2007), as it is the best predictor of many important life outcomes including education and occupation (Plomin & Deary, 2015). This means that people with higher IQ tend to be better educated, hold more prestigious occupations, and have higher incomes (Strenze 2007; Gottfredson, 2004). In addition socioeconomic measures that best predict health inequality also correlate most with intelligence **(**Gottfredson & Deary, 2004). IQ and education are closely related: they share genetic and environmental influences (Deary & Johnson 2010). It might be that education is at least partly an outcome of IQ (Deary & Johnson 2010) and might represent a partial proxy for individual differences in IQ (Batty & Deary, 2005).

The statement that intelligence is the fundamental cause behind socioeconomic differences has elicited controversies and somewhat differing results (e.g. Singh-Manoux, Ferrie, Lynch, & Marmot, 2005; Jokela, Elovainio, Singh-Manoux& Kivimäki, 2009; Batty, Der, Macintyre, & Deary, 2006; Link, Phelan, Miech, & Westin, 2008). It has been mainly studied in physical health with few exceptions in mental health issues (e.g. Rajput, Hassiotis, Richards, Hatch, & Stewart,

2011). Nevertheless several studies have found associations between low IQ and mental health issues (e.g. Caspi et al., 2014: Castellanos-Ryan et al., 2016; Cooper, Smiley, Morrison, Williamson, & Allan, 2007; Rajput et al., 2011; Power, Stansfeld, Matthews, Manor, & Hope, 2002). In relation to mental health care utilization no studies seem to exist. However, if it is true that intelligence explains socioeconomic differences in health, it could also predict socioeconomic differences in treatment utilization. It could also be an important factor to take into consideration when designing interventions. For example, many of those seeking treatment might have lower cognitive ability and could benefit from interventions aimed at improving mental health literacy (Koenen et al., 2009) as IQ has been shown to be the best predictor of health knowledge (Beier & Ackerman, 2003). Therefore cognitive ability might be an important factor to consider in prevention and treatment planning **(**Koenen et al., 2009).

1.4. Socioeconomic status and treatment utilization

It is well established that socioeconomic status plays an important role in many crucial aspects of well-being, including mental and physical health (Fryers et al., 2003; Marmot, 2010, p. 37; Kohn et al., 2004; Wilkinson & Marmot, 2003, p. 10-11). As SES indicators have been suggested to be mediating factors in IQ health association (e.g. Calvin, et al., 2010; Wrulich, et al., 2013) it is reasonable to apply this framework in examining mental health treatment utilization. However there seems not to be universal definition for SES (e.g. Amaddeo & Jones, 2007). Perhaps the most traditionally SES is measured with education, income, and occupational status (Adler & Newman, 2002; Glymour, Avendano, & Kawachi, 2014, p. 17; Lahelma, Martikainen, Laaksonen & Aittomäki, 2004; Reiss, 2013). SES can be seen as a complex and multifactorial phenomenon with various indicators (e.g. Braveman et al., 2005). Although education, occupation, and income show moderate associations (Geyer, Hemström, Peter, & Vågerö, 2006; Gotfredsson, 2004; Lahelma et al., 2004; Strenze, 2007), it has been argued these components measure different phenomena (Cutler, Lleras-Muney, & Vogl, 2008; Galobardes, Shaw, Lawlor, Lynch, & Smith, 2006), provide different resources (Adler & Newman, 2002), and causal mechanisms in relation to health (Adler & Newman, 2002; Braveman et al., 2005; Geyer et al., 2006; Cutler et al., 2008). Therefore, they cannot be used as indicators of a hypothetical latent dimension (Geyer et al., 2006). Treatment use has been associated with education, employment, and income, but the results considering the exact nature of these associations are somewhat contradictory.

Education, usually defined as number of years spent at school or acquired qualifications, is related to future opportunities, including income and occupation (e.g. Adler & Newman, 2002; Braveman

et al., 2005; Fryers et al., 2003; Galobardes et al., 2006; Glymour et al., 2014, p. 33-35; Lahelma et al., 2004). Education is usually acquired early in life and it offers knowledge, social capital, cognitive and emotional skills, and material resources therefore also partly reflecting parental SES and childhood social environment (Galobardes et al., 2006; Geyer et al., 2006; Glymour et al., 2014, p. 25-36). Higher education has been associated with utilization of mental health care: individuals with higher education use more (Wang et al., 2007) and areas where the population's education is in general higher treatment utilization more frequent (Steele, Glazier, & Lin, 2006). Education might also affect the type of the service used as more educated people are to be less likely to use primary care (Bijl & Ravelli, 2000; Kessler et al., 2003; 2005c; ten Have et al., 2003a;) but more likely to use mental health care (Bijl & Ravelli, 2000; Bijl et al., 2003; ten Have et al., 2003a; 2004; Wang et al., 2000). Moreover, those with lower education are to be less likely to utilize community mental health care (ten Have et al., 2003b), to receive adequate treatment by medication or therapy (Young, Klap, Sherbourne, & Weil, 2001; Wang et al., 2005b) and even to have had any treatment for mental health reasons (Andrews et al., 2001). Those with lower education might use more primary care (Wang et al., 2000). However, some studies have not found education to be associated with treatment (McAlpine & Mechanic, 2000; Wang et al., 2007).

Occupation can be defined as either being actively in working life or through the occupational status (Adler & Newman, 2002)**.** Occupational status can reflect one's status in the society (Galobardes et al., 2006), provide material source in relation to income (Galobardes et al., 2006; Lahelma et al., 2004) and other privileges such as access to better health care, housing, and a social network (Galobardes et al., 2006). Fewer studies have examined the relationship between occupation and treatment utilization. Some studies have associated unemployment with higher likelihood to use mental health care (Bijl & Ravelli, 2000) while others did not find this association (Andrews et al., 2001; Kessler et al., 2003). Employment has been associated with higher likelihood to consult a GP (Bebbington et al., 2000a) and use other treatment (Bebbington, et al., 2000b; ten Have et al., 2003b) but lower likelihood for treatment by psychoactive drugs (Bebbington et al., 2000b).

Lastly, income provides material resources for example in relation to living standards and services of better quality (Adler & Newman, 2002; Galobardes et al., 2006; Geyer et al., 2006; Glymour et al., 2014, p. 42). Income and treatment utilization have shown contradictory results. Some studies have shown low income to increase utilization (ten Have et al., 2003b). Contradictory, low income (Roy-Byrne, Joesch, Wang, & Kessler, 2009; Wang et al., 2005b) and more deprived areas (Meadows, Singh, Burgess, & Bobevski, 2002) have also shown lower rates of utilization. On the

other hand higher income have been associated with higher utilization (Wang et al., 2007). However not all have found associations between income with treatment use (Alegría, Bijl, Lin, Walters, & Kessler, 2000; Bijl & Ravelli, 2000; Kessler et al., 2003; 2005c; McAlpine & Mechanic, 2000; Young et al., 2001; Wang et al., 2007).

In addition to other measures of SES, racial and ethnic disparities also persist in several disease categories and service types (Mayberry, Mili, & Ofili, 2000). Those with non-white ethnicity have been shown to receive less treatment (Cook, McGuire, & Miranda, 2007; Williams et al., 2007). Racial disparities have been partly attributed to differences in English fluency (Fiscella, Franks, Doescher, & Saver, 2002; Sentell, Shumway, & Snowden, 2007). Furthermore, sociodemographic factors, including age (Andrews et al., 2001; Young et al., 2001; Wang et al., 2007) and gender (Andrews et al., 2001; Bebbington et al., 2000b; Bij & Ravelli, 2000; Bijl et al., 2003; Wang et al., 2005b; 2007) have been associated with treatment utilization.

Contradictory resuls have yielded about the relationship between treatment utilization and education, employment status, and income. Education might increase treatment utilization and affect the type of treatment received. Evidence about the relationship between income and occupational status and treatment utilization is, however, inconsistent and sparse. Therefore, more research is needed to clarify the nature of these relationships. In order to examine the effects of SES (Galobardes et al., 2006) and the underlying individual differences in psychopathology and intelligence multiple measures are needed to capture as much relevant socioeconomic information as possible (Braveman et al., 2005; Galobardes et al., 2006).

1.5. The Current study

Treatment gap, i.e. the unmet need for treatment, is high in mental health and therefore it is important examine factors associated with it. Comorbidity and severity of psychopathology have been found to be related to treatment utilization, but less is known about how transdiagnostic factors are related to utilization. Intelligence plays a role in mental health but has been underresearched in relation to treatment utilization. SES has been suggested to mediate the role of IQ in health differences (Calvin, et al., 2010; Wrulich, et al., 2013) as IQ have been proposed to be the underlying cause of socioeconomic differences (Gottfredson, 2004). The role of IQ in SES and treatment utilization has not been studied before. Moreover, evidence about socioeconomic differences in treatment utilization is scarce and somewhat contradictory, so more research is needed. The current study aims to shed more light to these questions by using a vast cross-sectional data. The current study examines how IQ, more specifically verbal IQ, and transdiagnostic

psychopathology, are associated with treatment utilization and does education, occupational status, and income mediate these associations. This study focuses on examining the structure of psychopathology according to the dimensional view by comparing three models: a) bi-factor model incorporating the general factor with the specific internalization and externalization factors, b) one-factor solution modelling only the p-factor, and c) two-factor solution modelling only the internalization and externalization factors. The best structure is then used in the subsequent mediation model examining whether education, occupational status and income mediate the association between psychopathology and IQ, and treatment utilization. This study aims to answer four study questions:

Study Question no 1.

Is psychopathology best modelled via one general psychopathology factor and two specific factors, one general factor or with two correlated factors?

Hypothesis 1. Psychopathology is best modelled via bi-factor model with one general factor, namely p-factor, and with two specific factors, namely internalization and externalization.

Study Question no. 2.

Is transdiagnostic psychopathology associated with treatment utilization directly and via education, occupational status and income?

Hypothesis 2. Psychopathology is related to higher odds for treatment utilization and education, occupational status and income mediate the association.

Study Question no 3.

Is IQ, namely verbal IQ, associated with treatment utilization directly and via education, occupational status and income?

Hypothesis 3. Verbal IQ is related to treatment utilization and education, occupational status and income mediate this association.

Study Question no. 4.

Are education, occupational status and income, related to treatment utilization?

Hypothesis 4. Education, occupational status and income are associated with higher likelihood to utilize treatment.

2. Methods

2.1. Sample

The Adult Psychiatric Morbidity Survey 2007 (APMS 2007) is the third in a series of surveys conducted every seven years by the National Centre for Social Research in collaboration with the University of Leicester (McManus, Meltzer, Brugha, Bebbington, & Jenkins, 2009a). The AMPS 2007 provides data on the prevalence of both treated and untreated psychiatric disorders in adults (aged 16 and over) living in private households in England. The AMPS 2007 was collected using a two-stage stratified probability sampling design. First, primary sampling units were selected from the Small Users Postcode Address File stratified for region and social class composition. Second, the households were randomly selected among these units. From the households housing more than one adult over 16, one adult was selected randomly. The interviews were conducted in two phases, with the first part conducted by trained lay interviewers in a computer-assisted format. For the second phase a sub-sample of phase one participants was invited for a more clinical assessment of psychosis, borderline and antisocial personality disorders, and autism spectrum disorder. Clinically trained interviewers employed by the University of Leicester carried out the phase two interviews. The technical features of the study, the training of the interviewers, and the selection process for phase two interviews are described in more detail elsewhere (see McManus et al., 2009a).

The AMPS 2007 was collected between October 2006 and December 2007. In 2007 57% (7,461) of those approached agreed to participate in the survey. Excluding the proxy interviews, there were 7,403 eligible cases. For the phase two interview, 849 were selected, of whom the interviews were conducted with 630 (74%). This study utilizes data from both phase one and two. From the 7,403 eligible phase one participants 7,382 had complete data on mental health care utilization. Information about level of education, income, and occupational status was available for 5,361 of them. In addition to these, 4,707 participants (56% women) had complete data on the mental health variables. This final sample with complete data on all the study variables was used in this study.

2.2. Measures

2.2.1. Mental health measures

All the variables were coded binary as (1) indicating existing problem, and (0) indicating mild or no symptoms. If not mentioned otherwise, readily available coding and cut-offs were used (for more details see McManus et al., 2009a)

Common mental disorders. Common mental disorders were assessed with the Revised Clinical Interview Schedule (CIS-R; Lewis, Pelosi, Araya, & Dunn, 1992). The questions included from the CIS-R were about somatic symptoms, fatigue, concentration and forgetfulness, sleep problems, irritability, worry about physical health, depression, depressive ideas, anxiety, phobias, panic, and compulsions and obsessions in the week prior to the interview. The questionnaire has 57 questions in total with four to five questions for each symptom category and each question answered 'yes' is worth 1 point. A summary score ranging from 0 to 57 was calculated and coded (0) less than 12 points indicating no clinically significant symptoms and (1) equal or above 12 points indicating the presence of a significant level of symptoms (McManus et al., 2009a).

Suicidal thoughts and attempts. Suicidal thoughts and suicide attempts were assessed with two questions from the CIS-R (Lewis et al., 1992): ***"****Have you ever thought of taking your life, even though you would not actually do it?"* and ***"****Have you ever made an attempt to take your life, by taking an overdose of tablets or in some other way?"*. Suicidal thoughts and attempts were coded into separate variables in the following way: (1) ever thought about suicide, (0) never thought about suicide; and (1) ever attempted suicide, (0) never attempted suicide.

Problematic eating. Possible eating disorder was assessed with SCOFF (Morgan, Reid, & Lacey, 1999). It includes five items (e.g. "In the last year have you lost more than one stone in a three month period?"). The original questionnaire was slightly altered for the purposes of the 2007 survey so that the participants were asked only about symptoms that had occurred within the last year. The order of the questions was also changed. Positive answers were worth one point each. A score more or equal to 2 indicates likely case of anorexia nervosa or bulimia (Morgan et al., 1999). The points were summed up and coded as follows (1) 2 or more points indicting possibly problematic eating, and (0) 1 or zero points indicating no problems with eating.

Antisocial and borderline personality disorder. The 2007 survey assessed only the presence of antisocial (ASPD) and borderline (BPD), but not other personality disorders. In phase one, participants completed the Structured Clinical Interview for Diagnostic and Statistical Manual

(SCID-II; First, Gibbon, Spitzer, Williams, & Benjamin, 1997) self-completion screen. A subset of participants was selected for a more clinical assessment of ASPD and BPD with the modules from the full semi-structured SCID-II. The probability to be selected for phase two for BPD depended on the total score of the screen, while for ASPD the probability depended on phase one scores for adulthood antisocial personality and childhood conduct disorder. The selection process and clinical judgment of the criteria is described in detail elsewhere (see McManus et al., 2009a).

For the purposes of this study, a variable indicating problematic personality was formed if a participant met one or more of the criteria from Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; American Psychiatric Association 4th edition, 1994) (in contrast to a diagnosis requiring to meet more than one). For ASP**,** DSM-IV indicates seven criteria to measure the presence of ASPD *(e.g. "*A failure to conform to social norms", 1= present, 0 = not present). Respondents younger than 18 were excluded from the assessment as particular behaviours must have persisted beyond the age of 18. For BP**,** DSM-IV indicates nine criteria to measure the presence of BPD (e.g. "frantic efforts to avoid real or imagined abandonment," 1= present, 0 = not present). A diagnosis of BPD is possible before the age of 18 and thus participants aged 16 and over were included. The following coding was applied for both antisocial and borderline personality disorder: (1) met one or more criteria, (0) met none of the criteria or was not included in the phase two interview.

Posttraumatic Stress Disorder (PTSD). Posttraumatic stress disorder was assessed with the Trauma Screening Questionnaire (TSQ; Brewin et al., 2002). First, participants were asked whether they had experienced a traumatic event or experience during their lifetime. Those stating they had were asked when this had last occurred. If the event or experience had occurred after the age of 16, the participant was then asked about ten different reactions to the event and whether they had experienced them at least twice during the past week (e.g. "Have you experienced, at least twice in the past week upsetting dreams about the event?", 1=yes, 0=no). The points were added up and further coded as following: (1) 6 or more points indicating a positive screen for PTSD, (0) less than 6 points indicating absence of PTSD (Brewin et al., 2002).

Attention deficit hyperactivity disorder (ADHD). ADHD was screened with the six-item Adult ADHD Self-report Scale (ASRS; WHO, 2003) in phase one. ASRS is a shortened version of the 18-item Symptom Checklist measuring the DSM-IV Criterion A symptoms of adult ADHD. The symptoms (e.g. "How often do you have trouble wrapping up the fine details of a project, once the challenging parts have been done?", 1=never, 5=very often) were considered significant if the

participant reported having experienced them often or very often. For the first three questions, the option "sometimes" was also considered to indicate significance of the symptom in question. Participant received one point for each significant symptom. The variable was further coded (1) 4 points or more indicating possibly clinically significant symptoms, and (0) 3 points or less indicating clinically non-significant symptoms (Faraone & Bierderman, 2005).

Hazardous drinking. Alcohol consumption was assessed with Alcohol Use Disorder Identification Test (AUDIT; Saunders, Aasland, Babor, Dela Fuente, & Grant, 1993). AUDIT includes 10 questions about alcohol consumption during the past year and covers the following aspects: *hazardous alcohol consumption* (frequency of drinking, typical quantity, frequency of heavy drinking), *harmful alcohol consumption* (feeling of guilt or remorse after drinking, blackouts, alcohol-related injury, other concern about alcohol consumption), and *symptoms of dependence* (impaired control over drinking, increased salience of drinking, morning drinking). Responses to the questions were scored from zero to four, and summed to form a total score ranging from zero to 40. The score was further coded as following (1) a score of 8 or higher indicating hazardous drinking, and (0) no problems with alcohol consumption (Saunders et al., 1993).

Drug dependence. Participants were asked if they had used any of the following drugs during the past year: cannabis, amphetamine, cocaine, crack, ecstasy, heroin/methadone, tranquillizers, or glue. To determine dependency the participants were asked five questions based on the Diagnostic Interview Schedule (Robins, Helzer, Croughan, & Ratcliff, 1981) about the frequency of the use, feelings of need or dependency, failed attempts to cut down the use, need for larger amounts, and experiencing withdrawal symptoms. If a participant had used any of the aforementioned drugs during the past year and answered 'yes' to any of the dependency questions, the participant was assigned (1) dependent on a drug, and otherwise (0) not dependent on a drug.

Gambling. Gambling behavior was assessed with 10 questions (e.g. "Are you preoccupied with gambling?", 1=yes, 0=no) based on the diagnostic criteria in DSM-IV to identify those having had problems with gambling during the past year. According to DSM-IV five or more criteria should be filled to screen positive for pathological gambling, but more inclusive score of three or more indicating 'problem gambling' have been used in previous studies (Fisher, 1996; Volberg, 1997). If a participant gave a positive answer to three or more of the questions, the participant was classified as (1) a problem gambler, and if not (0) a non-problem gambler.

Smoking. Smoking was defined as (1) smokes 7 or more cigarettes per week, (0) smokes less than 7 cigarettes per week.

2.2.2. Socioeconomic status (SES)

Education. Educational level was defined by the highest educational qualifications as follows: (1) Degree (equivalent to bachelor's degree or higher), (2) Teaching, nursing, or higher national degree, (3) A-levels, (4) General Certificate of Secondary Education (GCSE) or equivalent, (5) none**.** Those foreign degrees that could not be assigned to any other group were assigned as missing.

Occupational status. Occupational status was defined in the following way: (1) Never worked/not worked in last year, (2) Semi-routine/routine occupations, (3) Lower supervisory and technical occupations, (4) Small employers and own account workers, (5) Intermediate occupations, (6) Managerial and professional occupations.

Equalized household income. The total household income was defined by self-reported annual household gross income from any source. Participants were asked to indicate the appropriate banded estimate of household gross income (for more detail see McManus et al., 2009a). To have the level of income reflect participant's socioeconomic position more accurately, the total household gross income was adjusted for the number of people in the household with the McClement score. These scores take into account the number, ages, and relationships of adults and children in the household (for more information see McManus, Meltzer, Brugha, Bebbington, & Jenkins, 2009b). The total household gross income was divided by the McClement score to form the equalized household income. Participants were then further divided into quintiles as following (1) less than £10,575, (2) £10575 - £16,194, (3) £16,195 - £24,699, (4) £24,700 - £40,383, and (5) more than £40,384.

2.2.3. Verbal Intelligence

Verbal IQ was assessed with National Adult Reading Test (NART; Nelson, 1991). NART is a standardized test for estimating premorbid intelligence level of English speaking patients. The original test was developed by Haze Nelson (1982) and revised in 1991 (Nelson, 1982; 1991). The test includes 50 written irregular words in British English (e.g. NAUSEA). The words are irregular with respect to the common rules of pronunciation in order to test the participant's vocabulary rather than the ability to apply the common rules. The participant is required to pronounce the word correctly in order to get a point. The points are summed up forming the total score of NART ranging from 0 to 50. Performance on NART at age 77 has been shown to correlate highly with

childhood intelligence at age 11 (r=.73) indicating that NART primarily reflects intellectual ability (Crawford, Deary, Starr, & Whalley, 2001). NART has also been shown to correlate highly with WAIS-IV full scale intelligence (r=.69) (Bright, Hale, Gooch, Myhill, & van der Linde, 2016)

2.2.4. Treatment utilization

Whether or not the participant had received treatment for mental health reasons in the past year was assessed with the following criteria: 1) currently having any counseling or therapy for a mental, nervous or emotional problem, and 2) currently taking any ADHD, antidepressant, anxiolytic medication, hypnotic medication or anti-psychotic medication. The variable was coded: (1) is currently treated for mental health reasons, (0) is not currently treated. Other forms of health care were excluded as for example contacts with a general practitioner (GP) may merely reflect an administrative requirement, such as obtaining note for sick leave for an employer (Goddard & Smith, 2001).

2.2.5. Demographic confounders

Initially, age, gender, and ethnicity (Caucasian or other) were considered as potential confounders. Gender (0 female, 1 male) was significantly associated and therefore included. However, when adjusted for all the aforementioned study variables, age (OR= 1.00, p=.23) and ethnicity (OR=1.95, p=.19) were not significantly associated with treatment utilization and thus were excluded from the analyses.

2.3. Statistical analyses

2.3.1. Dimensional models of psychopathology

The structure of psychopathology was examined with three confirmatory factor analyses (CFA). First, a bi-factor model with a general psychopathology factor, i.e. the p-factor, and two specific factors, namely internalization and externalization, was examined. All measured mental health indicators were assumed to load on the p-factor and further on the two specific factors. Following previous research, common mental disorders, suicidal thoughts and attempts, problematic eating and PTSD were assumed to load on internalization factor and antisocial and borderline personality, ADHD, hazardous drinking, drug dependence, gambling, and smoking on externalization factor. Second, a model with just the p-factor was examined with all mental health indicators assumed to load on the p-factor. Third, a model with just the specific factors, were examined with the same indicators loading on the internalization and externalization factors as in the bi-factor model. Due to the scaling of the variables, the weighted least squares mean and variance adjusted estimator

(WLSMV; see Muthén, 1984; Muthén, du Toit & Spisic, 1997) was used. The fit of the covariance matrix was examined with $\chi 2$-test with the null hypothesis that model covariance structure and observed covariance structure do not differ from each other. As $\chi 2$-test may indicate poor fit of the covariance matrix in large samples (Cheung & Rensvold, 2002), model fit is also evaluated based on the comparative fit index (CFI), Tucker-Lewis index (TLI), and the root mean square error approximation (RMSEA) index. Acceptable cut-off criteria for the above mentioned fit indices with binary data are CFI ≥ .95, TLI ≥ .95 and RMSEA < .06 (Schreiber, Nora, Stage, Barlow, & King, 2006). The CFA was conducted with *lavaan* package (Rossel, 2012) in Rstudio (2017) with R version 3.3.3 (R Core Team, 2017).

2.3.2. Measurement invariance

The measurement invariance of the structure of psychopathology was examined to see whether the structure is the same with both genders. If invariance is not established, it is meaningless to conduct cross-group comparisons of mean differences or other structural parameters (Schmitt, & Kuljanin, 2008). The measurement invariance was examined with three confirmatory factor analyses following Millsap and Yun-Tein's (2004) guidelines. In the configural model (i.e. the baseline model) all parameters are freely estimated across groups. The weak invariance is established by constraining all free factor loadings to be equal across groups, here genders. The strict invariance is further established by fixing all unique variances of all groups to be 1. Usually strong invariance is also examined, however with dichotomous indicators this cannot be established as the thresholds in the configural invariance model are all equally constrained to set the scale. WLSMV was used as an estimator with theta parameterization (as recommended for measurement invariance). The CFA models were conducted with *lavaan* package (Rossel, 2012) in Rstudio (2017) with R version 3.3.3 (R Core Team, 2017).

2.3.3. Structural equation models

The mediation models were fitted with a WLMSV structural equation model (SEM). Three models were formed: model 1 included internalization factor, model 2 included externalization factor, and model 3 incuded both factors simultaneously. Otherwise all models included the same variables and associations. The hypothesized final model (model 3) is presented in Figure 1. The main outcome was treatment utilization, which was included as an observed variable. The model also included verbal IQ with an observed variable and the psychopathology factors as latent variables. Education, occupational status and income were used as observed variables. Verbal IQ and psychopathology factors had direct and indirect association via the education, occupation, and income to treatment

utilization. Education, occupation, and income had a direct effect on treatment utilization. Psychopathology factors also had a direct effect on verbal IQ. The fit of the covariance matrix was examined with $\chi 2$-test, and with fit indices CFI and RMSEA, as these are not affected by model complexity (Cheung & Rensvold, 2002). The standard errors (SE) for defined parameters were computed using the Delta method. The mediation model was computed with *lavaan* package (Rosseel, 2012) in Rstudio (2017) with R version 3.3.3 (R Core Team, 2017).

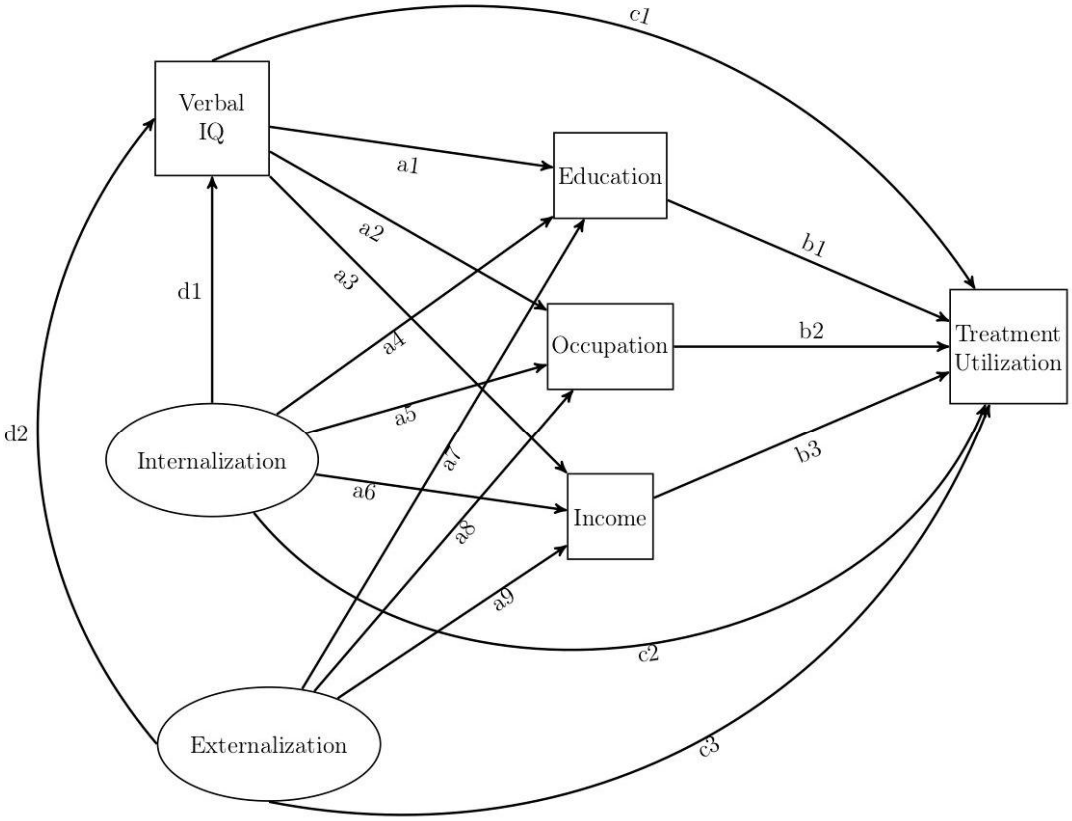

Figure 1. The hypothesized model. The paths c1, c2 and c3 stand for the direct effect of verbal IQ, internalization and externalization, respectively. The paths a1 to a9 and b1 to b3 stand for the indirect effects. Latent variable indicators, correlations between the latent variables as well as between the SES indicators, and errors are omitted.

2.3.4. Multiple imputation

Imputation procedures were conducted to correct for any possible bias resulting from missing values (White, Royston, & Wood, 2011). In the imputation, all available data from the study variables were used. The amount of missing values in each variable is presented in Table 1. All missing values were imputed applying the multiple imputation method using chained equations

(White et al., 2011). In the imputation, the mental health variables, education, income, occupational status, ethnicity, age, gender, and verbal IQ were used as predictors of all the other variables. Treatment was imputed but not used as a predictor. Binary variables (mental health variables and treatment utilization) were estimated with logistic regression, ordered variables (education occupation and income) with ordered logistic regression, and continuous variables (verbal IQ) with predictive mean matching. The data was imputed 10 times with five iterations each. The 10 imputed datasets were first pooled and then the above-mentioned statistical analyses were rerun using the imputed data (n= 7,403). The multiple imputation was computed using R version 3.3.3 with package MICE (Buuren & Groothuis-Oudshoorn, 2011).

Table 1.
Amount of missing observations in each of the study variables

	n in observed data	Missing (n)	Missing (%)	n in imputed data
Age	7,403	0	0	7,403
Gender	7,403	0	0	7,403
Education	6,949	454	6.1	7,403
Occupational status	7,047	356	4.8	7,403
Income	5,872	1,531	20.7	7,403
Verbal IQ	6,872	531	7.2	7,403
Common mental disorders	7,403	0	0	7,403
Suicidal thoughts	7,389	14	0.2	7,403
Suicidal attempts	7,395	8	0.1	7,403
Problematic eating	7,353	50	0.7	7,403
Borderline personality	7,403	0	0	7,403
Antisocial personality	7,403	0	0	7,403
PTSD	7,207	196	2.6	7,403
ADHD	7,397	6	0.1	7,403
Hazardous drinking	7,392	11	0.1	7,403
Drug dependency	7,356	50	0.7	7,403
Gambling	6,941	462	6.2	7,403
Smoking	7,393	10	0.1	7,403
Treatment utilization	7,382	21	0.3	7,403

3. Results

3.1. Descriptive statistics

Table 2 presents the characteristics of the study sample, while Supplement Table 1 (see Appendix A) provides the characteristics of the imputed sample (for descriptive statistics by gender see Supplement Tables 2 and 3 in Appendix A). There were no major differences between the study sample and the imputed sample. Correlations between the study variables are presented in Table 3 (for correlations in the imputed sample, see Supplement Table 4 in Appendix A). Treatment utilization was significantly correlated with all the study variables except with hazardous drinking and verbal IQ. Income, occupational status, and education correlated significantly and somewhat strongly with each other. Verbal IQ correlated significantly with all the SES indicators. Most of the mental health variables correlated significantly with each other.

Table 2.
Descriptive Statistics of the Study Sample (n=4,707)

Variable		Mean	SD	Range	Number	%
Age		50.92	17.17	16-95		
Gender	Women				2,642	56.0
	Men				2,065	44.0
Education		2.65	1.51	1-5		
Occupational status		3.17	2.14	1-6		
Income		3.12	1.41	1-5		
Verbal IQ		29.29	12.89	0-50		
Mental disorders	Common mental disorders				733	15.6
	Suicidal thoughts				713	15.2
	Suicidal attempts				254	5.4
	Problematic eating				282	6.0
	Borderline personality				139	3.0
	Antisocial personality				56	1.2
	PTSD				129	2.7
	ADHD				367	7.8
	Hazardous drinking				1,093	23.2
	Drug dependency				123	2.6
	Gambling				25	0.5
	Smoking				1,059	22.5
Treatment utilization					403	8.7

Note. SD= Standard deviation

Table 3.

Zero-order Correlations Between the Study Variables (n = 4,707)

Measures	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
1. Age																		
2. Gender	.02																	
3. Education	-.34	.06																
4. Occupational status	-.47	.09	.51															
5. Income	-.24	.12	.48	.55														
6. Verbal IQ	.09	.00	.43	.24	.32													
7. Common mental disorders	-.09	-.09	-.07	-.07	-.13	-.10												
8. Suicidal thoughts	-.11	-.05	.00	-.02	-.08	.00	.34											
9. Suicidal attempts	-.07	-.05	-.05	-.08	-.11	-.07	.26	.50										
10. Problematic eating	-.15	-.10	.02	.02	-.03	-.05	.22	.17	.15									
11. Borderline personality	-.10	.03	-.01	-.03	-.07	-.03	.23	.24	.27	.17								
12. Antisocial personality	-.07	.05	-.02	-.04	-.06	-.04	.14	.16	.20	.05	.48							
13. PTSD	-.06	-.04	.01	-.02	-.06	-.02	.28	.21	.18	.11	.15	.08						
14. ADHD	-.09	.01	.00	-.03	-.07	-.03	.31	.23	.16	.14	.20	.10	.20					
15. Hazardous drinking	-.16	.23	.08	.11	.11	-.01	.04	.05	.03	.05	.08	.10	.05	.08				
16. Drug dependency	-.15	.04	-.01	-.03	-.09	-.07	.11	.13	.11	.05	.17	.20	.06	.09	.10			
17. Gambling	-.03	.04	-.02	-.02	-.02	-.07	.07	.05	.05	.06	.04	.05	.04	.04	.06	.02		
18. Smoking	-.17	.01	-.14	-.06	-.14	-.17	.14	.13	.16	.04	.10	.11	.07	.08	.14	.19	.04	
19. Treatment utilization	-.01	-.09	-.04	-.09	-.12	-.02	.31	.24	.18	.09	.10	.07	.19	.00	.07	.07	.07	.07

Note. The correlations of ≥ |.05| are statistically significant at least at p<.01 (except between treatment utilization and hazardous drinking, where p=.96), and ≥ |.03| at p<.05 (except between gambling and age, where p=.07, and drug dependency and occupation, where p=.07)

3.2. Attrition analyses

Logistic regression was used to analyze attrition from the study sample. The results of the attrition analyses are reported in Supplement Table 5 (Appendix B). When examining the variables separately, the results showed those participants with higher education, occupational status, income, verbal IQ, borderline personality, and hazardous drinking were less likely to be excluded. When adjusting for the aforementioned variables with significant associations, the results showed that those participants with higher income were less likely (OR = 0.89) and those with borderline personality traits more likely (OR= 1.57) to be excluded from the study sample. To tackle this problem, analyses were rerun with the imputed sample**.**

3.3. Dimensional models of psychopathology

3.3.1 The structure of psychopathology

The structure of psychopathology was examined with three separate confirmatory factor analyses. The bi-factor model could not be estimated due to problems with identification. The results from the first-order confirmatory factor analysis for the p-factor are presented in the Supplement Tables 6 and 7 (see Appendix C). The model fit was acceptable, although CFI and TLI remained a little below the acceptable limits ($\chi 2$ [54]) = 550.591, $p < .001$, CFI= 0.937, TLI= 0.923, RMSEA= 0.044, 95% CI [0.041-0.048]). The model fit with the imputed data was acceptable as well ($\chi 2$ [54] = 931.063, $p < .001$, CFI = 0.929, TLI = 0.913, RMSEA = 0.047, [0.044-0.050]). All factor loadings were statistically significant (p<.001). Suicidal attempts (β=.91) and thoughts (β=.86) as well as antisocial (β=.87) and borderline personality (β=.84) loaded strongest on the p-factor. The loading of hazardous drinking was low (β=.24).

The results from the two-factor model are presented in Table 4 (for the results from imputed sample see Supplement Table 8 in Appendix C). The fit for this model was also acceptable ($\chi 2$ [53]) = 408.277, $p < .001$, CFI= 0.955, TLI= 0.944, RMSEA= 0.038, 95% CI [0.034-0.041]). The same was true for the imputed sample ($\chi 2$ [53]) = 653.695, $p < .001$, CFI= 0.951, TLI= 0.940, RMSEA= 0.039, 95% CI [0.036-0.042]). All factor loadings were statistically significant (p<.001). Suicidal thoughts (β=.88) and attempts (β=.92) loaded strongest on the internalization dimension while borderline (β=.87) and antisocial personality (β=.91) loaded strongest on the externalization factor. Similarly to the p-factor model, hazardous drinking loaded weakly to externalization factor (β=.28). The two factors correlated significantly (r=.81, p<.001). As the two-factor model fitted slightly

better compared to the one-factor model, and is theoretically more meaningful and better replicated, it was chosen for further analyses.

Table 4.
Summary of Confirmatory Factor Analysis for the Two-factor model using Weighted Least Squares Mean and Variance Adjusted Estimator (n=4,707)

	β	B	SE
Internalization			
Common mental disorders	.76	1.00	
Suicidal thoughts	.88	1.16	0.04
Suicidal attempts	.92	1.22	0.04
Problematic eating	.52	0.68	0.04
PTSD	.71	0.94	.05
Externalization			
Borderline personality	.87	1.00	0.05
Antisocial personality	.91	1.00	0.05
ADHD	.69	0.76	0.04
Alcohol Consumption	.28	0.31	0.04
Drug dependency	.62	0.78	0.06
Gambling	.44	0.49	0.10
Smoking	.46	0.50	0.04

Note. β=standardized factor loading, B= Factor loading, SE=standard error.

3.3.2 Measurement invariance

The two-factor model was not invariant across genders. Configural model was superior compared to the weak model ($\chi 2$ [107]) = 434.07 vs. $\chi 2$ [117]) = 477.93, p<.001, $\chi 2$ difference= 18.648, df difference = 6.793). Therefore, strict invariance was not further assessed, as these models are hierarchical in relation to each other.

3.3.3. Structure of psychopathology by gender

As the two-factor model was not invariant across genders, the model was rerun with multigroup analysis split by gender. The results are presented in Table 5 (for the results from the imputed sample see Supplement table 9 in Appendix C). The model fit in this model was acceptable ($\chi 2$ [106]) = 455.907.277, $p < .001$, CFI= 0.954, TLI= 0.943, RMSEA= 0.037, 95% CI [0.034-0.041]). Same was true for the imputed sample ($\chi 2$ [106]) = 625.213, $p < .001$, CFI= 0.957, TLI= 0.947,

RMSEA= 0.036, 95% CI [0.034-0.039]). The correlations between the factors were significant and strong for females (r=.80, p<.001) and males (r=.81, p<.001). All factor loadings were statistically significant (p<.001). Suicidal thoughts (β=.88 and β=.86) and attempts (β=.92 and β=.93) loaded strongest on the internalization dimension with both females and males, respectively. Borderline (β=.86 and β=.93) and antisocial personality (β=.91 and β=.93) loaded strongest on the externalization factor with both females and males, respectively. Similarly to the previous models, hazardous drinking loaded weakly to externalization factor with both females and males (β=.32 and β=.29, respectively). In contrast to previous models gambling loaded weakly too with females (β=.25).

Table 5.

Summary of Confirmatory Factor Analysis for the Two-factor Model using Weighted Least Squares Mean and Variance Adjusted Estimator (females n=2,642, males n= 2,065)

	Female			Male		
	β	B	SE	β	B	SE
Internalization						
Common mental disorders	.72	1.00		.81	1.00	
Suicidal thoughts	.88	1.22	0.05	.86	1.07	0.05
Suicidal attempts	.92	1.27	0.05	.93	1.15	0.05
Problematic eating	.55	0.75	0.06	.50	0.61	0.07
PTSD	.69	0.96	0.07	.75	0.92	0.07
Externalization						
Borderline personality	.86	1.00		.93	1.00	
Antisocial personality	.88	1.03	0.08	.93	1.07	0.06
ADHD	.68	0.79	0.06	.67	0.72	0.05
Hazardous drinking	.32	0.37	0.05	.29	0.31	0.05
Drug dependency	.57	0.66	0.08	.65	0.71	0.06
Gambling	.25	0.29	0.06	.51	0.56	0.10
Smoking	.43	0.50	0.05	.48	0.52	0.05

Note. β=standardized factor loading, B= Factor loading, SE=standard error. Correlation between the factors were for females (r=.80) and males (r=.81).

3.2. The structural equation models

The results from the model 1 with Internalization are presented in the Table 6 (the results from the imputed sample are presented in the Supplement Table 10 in Appendix D). The model fit was good ($\chi 2$ [50] = 307.086, p < .001, CFI= 0.957, TLI= 0.923, RMSEA= 0.047, 95% CI [0.042-0.052]). The fit was similar with the imputed sample ($\chi 2$ [50] = 448.573, p < .001, CFI= 0.978, TLI= 0.960, RMSEA= 0.046, 95% CI [0.043-0.050]). In the model 1, internalization was associated with higher

likelihood to utilize treatment with both genders. Internalization was associated with lower income within both genders, and with lower occupational status within males. Occupational status was associated with decreased odds for utilizing treatment, but only within males. Although verbal IQ was associated with higher education, occupational status and income in both genders, it was associated with higher likelihood to utilize treatment only in the female sample. The effect size of verbal IQ was, however, small. Internalization was associated with lower verbal IQ within females but showed no association with males. The imputed sample showed the same results, except for occupational status, which was associated with lower odds for utilizing treatment in both genders, and for verbal IQ, which was not associated with treatment utilization. In the study sample, occupational status was also was close to significant associated with lower odds for treatment utilization within females, and it is therefore likely that increased power caused the significant associations in the imputed sample.

The results from the model 2 with Externalization are presented in the Table 7 (the results from the imputed sample are presented in the Supplement Table 11 in Appendix D). The model fit was below acceptable limits ($\chi 2$ [88] = 447.562, $p < .001$, CFI= 0.896, TLI= 0.844, RMSEA= 0.042, 95% CI [0.038-0.046]). The model also showed a Heywood case with antisocial personality indicating anomalies with the model. However, the same was not true for the imputed sample as the model fit was good ($\chi 2$ [88] = 618.806, $p < .001$, CFI= 0.960, TLI= 0.940, RMSEA= 0.040, 95% CI [0.037-0.043]) and showed no Heywood cases. In the model 2, externalization was associated with higher likelihood to utilize treatment in both samples. Externalization was associated with lower income in the female sample and with lower occupational status in the male sample. Occupational status and income were associated with lower odds for treatment in both samples. In this model verbal IQ was also associated with higher education, occupational status and income in both genders, but was associated with higher likelihood to utilize treatment only in the female sample with a small effect size. Externalization was associated with lower verbal IQ in both samples. The imputed sample showed the same results except for income, which showed non-significant associations with treatment utilization within both genders, and for externalization, which was associated with lower income with both genders but was not associated with occupational status within males.

Table 6.

Individual Regression Associations from the Structural Equation Model 1 with Internalization (all fitted at the same time)

	Female (n=2,642)					Male (n=2,065)				
Treatment utilization	OR	95%CI	β	*p*	R^2=.330	OR	95%CI	β	*p*	R^2=.467
Education	0.993	(0.966-1.021)	-.011	.800		1.030	(0.997-1.065)	.045	.369	
Income	0.966	(0.939-0.993)	-.049	.211		0.946	(0.920-0.973)	-.076	.054	
Occupational status	0.968	(0.950-0.985)	-.071	.069		**0.946**	**(0.924-0.966)**	**-.120**	**.009**	
Internalization	**2.162**	**(2.044-2.286)**	**.557**	**<.001**		**2.206**	**(2.079-2.340)**	**.645**	**<.001**	
Verbal IQ	**1.005**	**(1.002-1.008)**	**.067**	**.048**		1.003	(1.000-1.006)	.036	.392	
Education	B	SE	β	*p*	R^2=.168	B	SE	β	*p*	R^2=.209
Internalization	0.004	0.053	.002	.940		0.017	0.055	.009	.775	
Verbal IQ	**0.050**	**0.003**	**.410**	**<.001**		**0.050**	**0.003**	**.456**	**<.001**	
Occupational status	B	SE	β	*p*	R^2=.049	B	SE	β	*p*	R^2=.076
Internalization	-0.136	0.082	-.045	.100		**-0.190**	**0.087**	**-.073**	**.028**	
Verbal IQ	**0.037**	**0.002**	**.212**	**<.001**		**0.040**	**0.004**	**.257**	**<.001**	
Income	B	SE	β	*p*	R^2=.132	B	SE	β	*p*	R^2=.123
Internalization	**-0.265**	**0.051**	**-.137**	**<.001**		**-0.300**	**0.053**	**-.175**	**<.001**	
Verbal IQ	**0.037**	**0.002**	**.322**	**<.001**		**0.029**	**0.002**	**.284**	**<.001**	
Verbal IQ	B	SE	β	*p*	R^2=.010	B	SE	β	*p*	R^2=.014
Internalization	**-1.718**	**0.465**	**-.102**	**<.001**		**-1.969**	**0.567**	**-.117**	**.001**	
Allowed covariances	COV	SE	r	*p*		COV	SE	r	*p*	
Education, income	**0.760**	**0.049**	**.427**	**<.001**		**0.651**	**0.051**	**.371**	**<.001**	
Education, occupation	**1.394**	**0.125**	**.483**	**<.001**		**1.212**	**0.110**	**.445**	**<.001**	
Income, occupation	**1.424**	**0.113**	**.519**	**<.001**		**1.336**	**0.104**	**.500**	**<.001**	

Note. Bolded variable names stand for the dependent variable (Treatment utilization, education, occupational status, income, and verbal IQ, respectively). All associations were fitted simultaneously. OR= Odds Ratio, CI= Confidence Interval, B=unstandardized estimate, SE=standard error, β=standardized estimate, COV=covariance, r=correlation.

Table 7.

Individual Regression Associations from the Structural Equation Model 2 with Externalization (all fitted at the same time)

	Female (n=2,642)					Male (n=2,065)				
Treatment utilization	OR	95%CI	β	*p*	R^2=.153	OR	95%CI	β	*p*	R^2=.309
Education	1.015	(0.986-1.045)	.023	.602		1.043	(1.009-1.080)	.064	.207	
Income	**0.960**	**(0.930-0.992)**	**-.057**	**.027**		**0.930**	**(0.901-0.960)**	**-.102**	**.021**	
Occupational status	**0.957**	**(0.938-0.976)**	**-.096**	**<.001**		**0.938**	**(0.916-0.961)**	**-.136**	**.007**	
Externalization	**1.664**	**(1.522-1.818)**	**.372**	**<.001**		**1.745**	**(1.658-1.911)**	**.507**	**<.001**	
Verbal IQ	**1.009**	**(1.006-1.011)**	**.108**	**.004**		1.005	(1.002-1.008)	.062	.163	
Education	B	SE	β	*p*	R^2=.170	B	SE	β	*p*	R^2=.209
Externalization	0.080	0.073	.039	.277		-0.026	0.063	-.015	.674	
Verbal IQ	**0.049**	**0.003**	**.339**	**<.001**		**0.050**	**0.003**	**.454**	**<.001**	
Occupational status	B	SE	β	*p*	R^2=.048	B	SE	β	*p*	R^2=.074
Externalization	-0.105	0.113	-.036	.350		0.135	0.091	-.056	.139	
Verbal IQ	**0.037**	**0.005**	**.207**	**<.001**		**0.039**	**0.005**	**.255**	**<.001**	
Income	B	SE	β	*p*	R^2=.150	B	SE	β	*p*	R^2=.123
Externalization	**-0.381**	**0.070**	**-.200**	**<.001**		**-0.284**	**0.053**	**-.178**	**<.001**	
Verbal IQ	**0.032**	**0.003**	**.281**	**<.001**		**0.028**	**0.002**	**.269**	**<.001**	
Verbal IQ	B	SE	β	*p*	R^2=.076	B	SE	β	*p*	R^2=.038
Externalization	**-4.616**	**0.657**	**-.276**	**<.001**		**-3.053**	**0.582**	**-.196**	**<.001**	
Allowed covariances	COV	SE	r	*p*		COV	SE	r	*p*	
Education, income	**0.744**	**0.049**	**.423**	**<.001**		**0.649**	**0.052**	**.370**	**<.001**	
Education, occupation	**1.389**	**0.125**	**.482**	**<.001**		**1.212**	**0.110**	**.444**	**<.001**	
Income, occupation	**1.422**	**0.114**	**.524**	**<.001**		**1.344**	**0.105**	**.503**	**<.001**	

Note. Bolded variable names stand for the dependent variable (Treatment utilization, education, occupational status, income, and verbal IQ, respectively). All associations were fitted simultaneously. OR= Odds Ratio, CI= Confidence Interval, B=unstandardized estimate, SE=standard error, β=standardized estimate, COV=covariance, r=correlation.

The results from the structural equation model 3 with both latent factors are presented in the Table 8 and in Supplement Figures 1 and 2 in Appendix D (the results from the imputed sample are presented in the Supplement Table 12 in Appendix D). The model fit was acceptable ($\chi 2$ [206] = 945.489, $p < .001$, CFI= 0.921, TLI= 0.895, RMSEA= 0.039, 95% CI [0.037-0.044]). The fit was similar with the imputed sample ($\chi 2$ [206] = 1315.300, $p < .001$, CFI= 0.950, TLI= 0.934, RMSEA= 0.038, 95% CI [0.036-0.040]). In the model 3, only internalization was associated with higher odds for treatment utilization within both genders. Occupational status and income were associated with lower odds for utilizing treatment but only within males. Like in the other models, verbal IQ was associated with higher education, occupational status and income in both genders, but in this model verbal IQ was not associated with treatment utilization. Externalization was associated with lower verbal IQ within both genders but internalization was associated with higher verbal IQ within females. The imputed sample showed the same results apart from occupational status showing lower odds for treatment utilization within both samples and income showing no significant associations. Internalization was associated with lower occupation and income in the imputed sample but only within males.

Table 8.

Individual Regression Associations from the Structural Equation Model 3 with both Latent Factors (all fitted at the same time)

	Female (n=2,642)					Male (n=2,065)				
Treatment utilization	OR	95%CI	β	*p*	R^2=.331	OR	95%CI	β	*p*	R^2=.461
Education	0.995	(0.968-1.023)	-.008	.847		1.030	(0.997-1.034)	.046	.358	
Income	0.956	(0.927-0.986)	-.062	.144		**0.945**	**(0.919-0.971)**	**-.080**	**.046**	
Occupational status	0.970	(0.952-0.979)	-.066	.104		**0.945**	**(0.924-0.966)**	**-.120**	**.010**	
Externalization	0.881	(0.740-1.048)	-.106	.464		0.974	(1.030-0.834)	-.024	.867	
Internalization	**2.316**	**(1.958-2.740)**	**.636**	**<.001**		**2.177**	**(2.054-2.550)**	**.660**	**<.001**	
Verbal IQ	1.004	(1.001-1.007)	.052	.195		1.003	(1.000-1.006)	.034	.425	
Education	B	SE	β	*p*	R^2=.168	B	SE	β	*p*	R^2=.209
Externalization	-0.009	0.165	-.005	.954		-0.029	0.152	-.017	.851	
Internalization	0.013	0.160	.006	.937		0.008	0.150	.005	.957	
Verbal IQ	**0.050**	**0.004**	**.410**	**<.001**		**0.050**	**0.003**	**.455**	**<.001**	
Occupational status	B	SE	β	*p*	R^2=.142	B	SE	β	*p*	R^2=.076
Externalization	0.070	0.256	.027	.785		0.002	0.222	.001	.994	
Internalization	-0.185	0.249	-.065	.456		-0.182	0.229	-.073	.428	
Verbal IQ	**0.038**	**0.005**	**.216**	**<.001**		**0.040**	**0.005**	**.257**	**<.001**	
Income	B	SE	β	*p*	R^2=.049	B	SE	β	*p*	R^2=.126
Externalization	-0.303	0.256	-.182	.051		-0.169	0.122	-.111	.167	
Internalization	0.011	0.249	.006	.940		-0.140	0.128	-.085	.271	
Verbal IQ	**0.033**	**0.005**	**.293**	**<.001**		**0.028**	**0.002**	**.273**	**<.001**	
Verbal IQ	B	SE	β	*p*	R^2=.082	B	SE	β	*p*	R^2=.039
Externalization	**-6.441**	**1.489**	**-.440**	**<.001**		**-4.024**	**1.462**	**-.270**	**.006**	
Internalization	**4.010**	**1.524**	**.248**	**.009**		1.626	1.556	.101	.292	
Allowed covariances	COV	SE	r	*p*		COV	SE	r	*p*	
Education, income	**0.759**	**0.050**	**.429**	**<.001**		**0.650**	**0.051**	**.371**	**<.001**	
Education, occupation	**1.394**	**0.125**	**.483**	**<.001**		**1.212**	**0.110**	**.445**	**<.001**	
Income, occupation	**1.430**	**0.114**	**.525**	**<.001**		**1.336**	**0.104**	**.502**	**<.001**	
External, internalization	**0.503**	**0.033**	**.795**	**<.001**		**0.633**	**0.036**	**.812**	**<.001**	

Note. Bolded variable names stand for the dependent variable (Treatment utilization, education, occupational status, income, and verbal IQ, respectively). All associations were fitted simultaneously. OR= Odds Ratio, CI= Confidence Interval, B=unstandardized estimate, SE=standard error, β=standardized estimate, COV=covariance, r=correlation.

4. Discussion

This study utilized a cross-sectional, representative national data from England. The results showed that comorbidity of mental disorders can be modelled with two latent transdiagnostic factors, namely internalization and externalization. These factors were not invariant across genders. Psychopathology, especially internalization, was associated with higher likelihood to utilize treatment. Psychopathology showed some significant associations with occupational status, but these were not highly consistent. Verbal IQ was associated with education, income and occupational status, but showed minimal to nonsignificant effect on treatment utilization. Occupational status on the other hand was associated with lower likelihood to utilize treatment. Income was also found to lower odds for treatment utilization, but this association was less consistent and not evident in the imputed results. Psychopathology, especially externalization, was associated with lower verbal IQ. The imputed results differered from the results of the study sample to some extent, indicating that attrition might affected the results, but none of these were contradictory in light of study results. To conclude, it seems that mostly internalization is behind the treatment utilization.

4.1. Treatment utilization

In this study around 9% of the sample used either psychotherapy or counseling with or without psychoactive medication. This is comparable to the estimates acquired previously (e.g. Bebbington et al., 2000b; Wang et al., 2000; Wittchen et al., 2011). This study was also consistent with previous research in that women utilized treatment more (approximately 11%) compared to men (approximately 6%) (Andrews et al., 2001; Bebbington et al., 2000b; Bij & Ravelli, 2000; Bijl et al., 2003; Wang et al., 2005b; 2007).

Both internalization and externalization were associated with higher likelihood to utilize treatment, but only internalization showed higher likelihood for utilizing treatment when the factors were assessed together. This finding is in line with previous research in that comorbidity and severity have been associated with treatment use (Andrews et al., 2001; Bebbington, et al., 2000a; 2000b; Bijl et al., 2003; Demyttenaere et al., 2004; Jacobi et al., 2004; Kessler et al., 2003; 2005c; Mojtabai et al., 2002; ten Have et al., 2004; Wang et al. 2000; 2007; Wichen & Jacobi, 2005). Internalization has also previously been associated with higher likelihood to utilize treatment (Rodriguez-Seijas et al., 2017; Sunderland & Slade, 2015) above specific disorders (Sunderland & Slade, 2015). Externalization has also been previously shown to be associated with higher likelihood to utilize especially domain specific, i.e. designed for substance use disorder, treatment (Rodriguez-Seijas et

al., 2017). However, in the same study when both internalization and externalization were assessed together, the effect of externalization was significantly reduced while the effect of internalization remained large in relation to utilizing any treatment (Rodriguez-Seijas et al., 2017). These findings are in line with the current study in that when examined together, only internalization remained as significant predictor of treatment utilization. Comorbidity have also been associated with perceived need (Mojtabai et al., 2002), which could partly explain the current results.

Although externalization and internalization did share a high amout of variance, approximately one-third of the variance was unique to each factor. These unique variances might also be important factors in treatment utilization. The finding that externalization was not associated with treatment utilization when assessed together with internalization is to some extent in line with previous findings about substance abuse and treatment. Previously especially treatment gap in alcohol abuse and dependence has been estimated among the highest, at 78,1% (Kohn et al., 2004). Also previous analyses with the data used here have shown 81% of those in the externalizing cluster (even though differently specified) to be undertreated (McManus et al., 2009a). There are many factors that might prevent treatment use, and these barriers can be both structural, financial and treatment related, or attitudinal (e.g. Mojtabai, 2005; Sareen et al., 2007). Attitudinal barriers, including low perceived need, e.g. thoughts that the problem would get better on its own or will to manage the problem by oneself, have been found to be more prevalent (e.g. Andrade et al., 2014; Sareen et al., 2007) and more important in initiating and continuing treatment compared to structural barriers (Andrade et al., 2014). The results could partly be explained by attitudinal barriers that have been suggested to explain majority of the unmet need (Steele et al. Dewa, & Lee, 2007). Attitudinal barriers might be even higher among those suffering from externalization and they might be more prone to abuse substances as an attempt to selfmedicate. These attitudinal barriers were not, however, examined in this study and therefore future studies should include measures of these barriers when examining treatment utilization. These findings provide further support for the utility of the transdiagnostic factors in both while examining treatment utilization and planning interventions.

Even though previous research suggests that those seeking treatment have lower cognitive ability (Koenen et al., 2009), in this sample verbal ability showed minimal to no effect on treatment utilization. This study was consistent with the previous research in that the higher IQ was related to higher education, occupational status and income (e.g Plomin & Deary, 2015; Strenze, 2007). Of these higher occupational status was most robustly associated with lower odds for treatment utilization. However, the direct influence of IQ to treatment utilization was minimal to nonsignificant and even more so, contradictory to how occupation affected treatment utilization.

Therefore, it is less likely that the effect of any of the SES indicators on treatment utilization reflect mainly (verbal) IQ.

A surprising finding was that education was not associated with treatment utilization neither among women or men. This is not in line with the previous research indicating that higher education is related to special mental health care (Bijl & Ravelli, 2000; Bijl et al., 2003; ten Have et al., 2003a; 2004; Wang et al., 2000) and lower education with lower odds to have adequate treatment via medication and therapy (Young et al., 2001; Wang et al., 2005b). However, some previous studies not have found associations between education and treatment (McAlpine & Mechanic, 2000; Wang et al., 2007). The contradictory findings indicate that the association between education and treatment utilization is not straightforward and warrant more reseach.

Higher occupational status was consistently associated with lowed odds for utilizing treatment. Also higher income was associated with lower odds, but less concsistently. These results are in line with the finding that employment is associated with lower use of drug treatment (Bebbington et al., 2000b) and that low income has been associated with higher utilization (ten Have et al., 2003b). Perhaps those with higher occupational status experience less stress through better work environment (Adler & Newman, 2002) and have better social network as well as other privileges (Galobardes et al., 2006) lowering the probability of mental health issues and thus reducing the need for mental health treatment. Contradictory results have also yielded (e.g. Wang et al, 2007). To my knowledge this is the first study to find an association between occupational status and treatment utilization. These results provide some support on the effect of socioeconomic differences in treatment utilization, but to reach a more coherent understanding of these relationships more research is needed in diverse populations.

4.2. The structure of psychopathology

This study examined three different structures of psychopathology. The bi-factor structure could not be modelled due to identification issues, unlike in many previous studies. However, the well-established two-factor model with internalization and externalization was found in this sample as well. The one-factor solution with a general psychopathology factor fitted almost as well as the two-factor solution, thus statistically, they could not be clearly distinguished. The two factors also correlated highly indicating large amount of shared variance. This could also point to the absence of the general factor. Although these structures cannot be clearly disdingued in the current study, the two factors seem to be theoretically more solid and utility of the general factor seems to be more relevant in the framework of bi-factor models. In addition, compared to the one factor solution, the

utility of two-factor solution is better supported, as the factors have shown among others interaction effects in treatment utilization (Rodriguez-Seijas et al., 2017).

Previous studies have found general psychopathology, i.e. p-factor, to bee invariant across genders (Caspi et al., 2014; Patalay et al., 2015). Internalization and externalization factors have yielded less consistent evidence, as other have found them to be invariant across genders (Eaton et al., 2012; Hicks et al., 2007; Kramer, Krueger, & Hicks, 2008), and others suggested them to be highly gendered with men showing stronger association on externalization and women on internalization (Caspi et al., 2014). In the current study externalization and internalization were not invariant across genders. Although the specific factors did not prove invariant, they showed similar associations with treatment utilization across genders. The factor loadings also showed differences in magnitude, but showed similar trends in across genders, with suicidal thoughts and attempts loading strongest on the internalization liability and antisocial and borderline personality on the externalization factor. Future studies should examine gender differences in externalization and internalization to clarify the nature of these differences. If the factors are gendered in style, this could be taken into consideration in targeting those at risk and in need of treatment.

One of the mental health indicators used here, i.e. borderline personality, has been found to load on both internalization and externalization (e.g. Carragher et al., 2015; Eaton et al., 2011; Kotov et al., 2011). In the current study borderline personality also seemed to load rather strongly on to the assigned factor and the overall fit of the structure proved acceptable as well. However, no exploratory analyses were made, thus it is unclear if the indicators would have loaded on to different factors. Regarding the factor loadings, one somewhat surprising finding was that hazardous drinking loaded quite weakly on the externalization and on the general psychopathology factor. Hazardous drinking is not necessarily the same as alcohol dependence, which has been previously shown higher loadings on the externalization factor (Markon, 2010). Hazardous drinking implicates problems with alcohol, but measures more related to dependence might be more useful in future studies.

Psychopathology was also associated with verbal IQ, which is in line with previous research (Caspi et al., 2014; Castellanos-Ryan et al., 2016; Lahey et al., 2015). Especially externalization was consistently associated with lower verbal IQ with both genders. The current findings are consistent with the previous findings indicating that verbal comprehension is associated negatively with externalization (Caspi et al., 2014; Castellanos-Ryan et al., 2016; Lahey et al., 2015). Also other measures of intelligence and executive functions have been shown to have negative associations

with externalization and internalization, and especially with the general factor (Caspi et al., 2014; Castellanos-Ryan et al., 2016; Lahey et al., 2015). Somewhat surprisingly, when assessing the factors together, internalization was associated with higher verbal IQ, but only with women. Previously, internalization, examined within a bifactor model, have shown positive association with verbal comprehension (Caspi et al., 2014), but negative (Lahey et al., 2015) or nonsignificant associations were found when examined without the bifactor structure (Caspi et al., 2014; Castellanos-Ryan et al., 2016). The positive association between internalization and verbal IQ is in line with the notion that internalization has been associated with better academic performance among girls (Lahey et al., 2015). However, the change on the direction of the association in different models could also reflect bias due to multicollinearity.

4.3. Strengths and limitations

This study has some limitations, which are important to keep in mind when interpreting the results. The main limitation of this study is the use of cross-sectional data. This approach does not allow confirming any causal assumptions. As verbal IQ, SES and psychopathology along with treatment utilization were measured at the same time, it is hard to determine causal directions. The relationships between verbal IQ and education as well as between verbal IQ and occupation measured in adulthood could also, to some extent, reflect environmental effects, for example, by exposure to richer vocabulary. The association between psychopathology and verbal IQ could reflect shared variance (Koenen et al., 2009) or it could reflect the possible detrimental effect suffering from mental health disorder could have, if not on IQ, on test functioning. The relationship between psychopathology and SES could also be bidirectional. SES could operate through social selection, i.e. mental illness might predispose to poor SES or through social causation, i.e. mental illness might result from poor SES due to the high stress load associated with it.

A related limitation is that equivalent or nearly equivalent models, i.e. models nearly indistinguishable or nearly indistinguishable at a statistical level (overall fit), but differing by interpretation, were not considered in this study. For further development of the theory and model, examination of plausible equivalent models should be included. In addition, there are alternative models for examining the positive manifold found among mental health variables (for a discussion see e.g. Lahey et al., 2012 and van Bork et al., 2017) and other ways to measure connections between the core symptoms, e.g. network analysis (e.g. van Bork et al., 2017) that could be considered in later studies.

Another limitation of this study is the use of verbal reading test as a proxy for IQ, even though it correlates rather highly with other measures of IQ (Bright et al., 2016). Moreover, verbal IQ was assessed only with one variable. It would have been better to model IQ as a latent variable, but this would have required more indicators, e.g. measures of performance IQ. Using verbal test based on English vocabulary might not be suitable for those whose first language is not English, possibly leaving the sample more homogenous in terms of ethnic background. However, attempts were made to adjust the analysis for ethnicity, and after adjusting for other variables, it was not associated with treatment utilization.

Using self-reports might affect estimates of mental health care, as it has been suggested that there might be recall bias present especially among those more distressed (Rhodes, Lin, & Mustard, 2002). However, it has also been suggested that self-reporting might be preferable compared to computerized provider records and that reporting current treatment is more accurate (Ritter et al., 2001). Using self-reports might also be source of common method bias. In addition, although the sampling design in most part provides representative data, some sampling error always occurs. To compensate, sampling weights have been calculated for the data (McManus et al., 2009a), but these weights could not be applied as *lavaan* did not yet support sampling weights with dichotomous indicators (Rosseel, 2014). Furthermore, one of the analyses showed a Heywood case, which would indicate anomalies in the analysis. However, this was not the case with the other analyses, that showed otherwise similar results. The direction of the association between internalization and verbal IQ also changed to opposite, which could indicate additional bias due to multicollinearity. Some variables, including income, also showed a large amount of missing values.

Despite these limitations, the current study has also a number of strengths. This study takes into consideration multiple aspects both socioeconomic status and psychopathology as well as verbal IQ. To my knowledge, these have not been previously studied together to examine treatment utilization. This study is also among the first to associate internalization and externalization liabilities with treatment utilization. To my knowledge, only two studies have integrated these liabilities within the field of treatment utilization (Rodriguez-Seijas et al., 2017; Sunderland & Slade, 2015). Furthermore, nationally representative sample and the use of standardized and validated questionnaires to assess mental health problems allows generalization. Finally, a non-clinical population was used, yielding a more accurate understanding of mental health utilization in the population. This also allowed avoiding selection-related effect better than in clinical studies.

4.3. Clinical implications

This study raises some clinical implications. Firstly, this study also supports the notion that not all who need treatment receive it. Especially those strong on externalization could be at risk for undertreatment. This study provides further support to that mental disorder comorbidity is a key explaining factor in treatment utilization and for using the transdiagnostic approach when examining those seeking help. Transdiagnostic approach could provide a useful tool for targeting those at risk for not receiving treatment. It is well established that disorders in our leading psychiatric nosology are based on arbitrary thresholds (Carragher et al., 2015) and these are assessed with time consuming diagnostic interviews. Alternatively, the transdiagnostic liabilities could be screened with shorter interviews and questionnaires concentrating on key impairments, e.g. negative emotion and negative attention bias or impulsivity and behavioral dysfunction. To add an example, schools and physicians screening more proactively could identify individuals with problematic behavior, and impulsivity, or with significant amount of negative emotionality. This approach could also prove useful in cases with high comorbidity or when a patient reports high amount of distress but fails to meet full criteria of any specific diagnosis (e.g. Wilamowska et al., 2010).

Furthermore, the notion that transdiagnostic factors are associated with treatment utilization provides further support for applying the approach in planning treatments. As for substantial amount of mental disorders onset occurs on the fist decades of life (Kessler et al., 2005a) early interventions might help to diminish the severity and persistence (e.g. De Girolamo et al, 2012). For example, internalization seems to be a target of efficient transdiagnostic interventions (e.g. Farchione et al., 2912; Wilamowska et al., 2010). In addition, as argued by Carragher et al., (2016) those strong on the externalization liability would benefit from interventions aimed at targeting impulsivity and sensation seeking. Although internalization was associated with increased odds for treatment utilization, individuals could further benefit from interventions targeting negative thinking and anxiety sensitivity (Carragher et al, 2016). Furthermore, applying the transdiagnostic approach could faciliate the training on mental health care providers (Wilamowska et al., 2010). These notions further highlights focusing the interventions on to the key impairments of the transdiagnostic liabilities and the utility of the transdiagnostic approach in mental health care settings.

4.4. Future studies

From the framework of this study stems few main lines of new research. Firstly, the findings from this study should be replicated especially with prospective and longitudinal research to ensure these

assumed causal associations exist in the contex of treatment utilization. The psychopathology structure should also be extended to include the thought factor. In the current study it was excluded, because the inclusion of this factor would have required more measurements of indicators of psychosis and mania or perhaps required going into more depths in the symptoms to have enough indicators per factor. Previous research have shown people with psychotic disorders to have higher utilization rates in both absolute and relative terms compared to those with non-psychotic disorders (Carr, Johnston, Lewin, Rajkumar, Carter, & Issakidis, 2003). Further, those with schizophrenia diagnosis have been shown to account for a significant proportion mental health service use (Short, Thomas, Luebbers, Ogloff, & Mullen, 2010) and psychotic disorders have been shown to have lower treatment gap compared to others (Kohn et al., 2004). Also those with bipolar disorder have been found to have higher utilization rates (Dean, Gerner, & Gerner, 2004). Therefore, thought factor seems clearly important in both psychopathology and treatment utilization. Also the subfactors of internalization, i.e. fear and distress, were left outside the focus of this study. In further studies these should be incorporated to examine the effects. Further, transdiagnostic factors should be compared with alternative frameworks for the emerged positive manifold among mental disorders to test and develop hypotheses about their comorbidity.

Secondly, research should focus on examining the relationship of psychopathology and treatment in more depth. Previously other measures of treatment have been used in the context of transdiagnosic factors (Sunderland & Slade, 2017; Rodriguez-Seijas et al., 2017) but as in the current study, these were summed as a dichotomous measures indicating simply whether participant had used treatment or not. This indicates more in depth analysis of different use of services sectors as well as number of visits. Research should examine, how internalization and externalization are related to lifetime treatment utilization, utilization by service sector and number of visits and further carry on examining how these liabilities could be treated. The interaction effects found by Rodriques-Seijas et al. (2017) should also be included in further examination. In addition, closer examination of treatment paths should be incorporated to see how internalization and externalization might affect them. From previous literature we know, that it can take up to years from initial symptoms before initiating treatment (e.g. De Girolamo, et al., 2012). To ensure the distressed receive adequate treatment in a timely manner, we need more research on what happens before initiating treatment and how treatment is further carried on. In addition, assessing especially attitudinal barriers for treatment should be included to see how they are related to transdiagnostic factors and how these interact together in relation to treatment utilization.

Lastly, although intelligence did not show strong associations with treatment utilization, to my knowledge, this is the first study to consider the role of intelligence in treatment utilization. Therefore more research is warranted. Further, IQ should be examined in relation to treatment outcomes, for example, if it affects understanding and learning the content of interventions.

4.5. Conclusions

This study adds to the growing evidence of the utility of transdiagnostic psychopathology by showing that mental disorder comorbidity can be modeled with internalization and externalization. In light of this study, psychopathology, especially internalization, seems to be the best predictor of treatment utilization. This notion emphasizes the utility of transdiagnostic aproach in examining those who seek treatment and futher their utility in the context of mental health care. The current study was also the first to find that occupational status lowers odds for utilization and that verbal IQ did not seem to contribute to treatment utilization. These findings warrand more research, especially with prospective study designs. Future studies should also focus more in depth on how the transdiagnostic factors are related to the initiation, continuation and outcomes of treatment. In addition, assessing especially attitudinal barriers for treatment should be included to gain a profound underderstanding about their relationship to transdiagnostic factors and how these interact together in realation to treatment utilization.

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Appendix A

Descriptive statistics from the imputed sample

Supplement Table 1.
Descriptive Statistics of the Impute Sample (n=7,403)

Variable		Mean	SD	Range	Number	%
Age		51.12	18.59	16-95		
Gender	Women				4,206	56.8
	Men				3,197	43.2
Education		2.52	1.49	1-5		
Occupational status		2.99	2.10	1-6		
Income		2.98	1.40	1-5		
Verbal IQ		28.35	13.37	0-50		
Mental disorders	Common mental disorders				1,187	16.0
	Suicidal thoughts				1,081	14.6
	Suicidal attempts				388	5.2
	Problematic eating				454	6.1
	Borderline personality				195	2.6
	Antisocial personality				80	1.1
	PTSD				224	3.0
	ADHD				588	7.9
	Hazardous drinking				1,604	21.7
	Drug dependency				202	2.7
	Gambling				45	0.6
	Smoking				1,620	21.9
Treatment utilization					649	8.8

Note. SD= Standard deviation.

Descriptive statistics by gender from both samples

Supplement Table 2.
Descriptive statistics of the Study Sample by Gender

	Female (n=2,642)					Male (n=2,065)				
Variable	Mean	SD	Range	Number	%	Mean	SD	Range	Number	%
Education	2.57	1.50	1-5			2.74	1.51	1-5		
Occupational status	3.00	2.16	1-6			3.38	2.12	1-6		
Income	2.96	1.40	1-5			3.31	1.40	1-5		
Verbal IQ	29.31	12.23	0-50			29.27	13.70	0-50		
Common mental disorders				489	18.5				244	11.8
Suicidal thoughts				442	16.7				271	13.1
Suicidal attempts				169	6.4				85	4.1
Problematic eating				214	8.1				68	3.3
Borderline personality				65	2.5				74	3.6
Antisocial personality				18	0.7				38	1.8
PTSD				86	3.3				43	2.1
ADHD				197	7.4				170	8.2
Hazardous drinking				390	14.8				703	34.0
Drug dependency				54	2.0				69	3.3
Gambling				7	0.3				18	0.9
Smoking				587	22.2				472	22.9
Treatment utilization				282	10.7				121	5.9

Note. SD= Standard deviation.

Supplement Table 3.
Descriptive Statistics of the Imputed Sample by Gender

	Female (n=4,206)					Male (n=3,197)				
Variable	Mean	SD	Range	Number	%	Mean	SD	Range	Number	%
Education	2.45	1.48	1-5			2.62	1.49	1-5		
Occupational status	2.84	2.10	1-6			3.19	2.08	1-6		
Income	2.84	1.39	1-5			3.16	1.40	1-5		
Verbal IQ	28.56	12.87	0-50			28.07	14.00	0-50		
Common mental disorders				796	18.3				391	12.2
Suicidal thoughts				677	16.1				404	12.6
Suicidal attempts				262	6.2				126	3.9
Problematic eating				349	8.3				105	3.3
Borderline personality				98	2.3				97	3.0
Antisocial personality				24	0.6				56	1.8
PTSD				147	3.5				77	2.4
ADHD				325	7.7				263	8.2
Hazardous drinking				601	14.3				1003	31.4
Drug dependency				82	1.9				120	3.8
Gambling				10	0.2				35	1.1
Smoking				900	21.4				720	22.5
Treatment utilization				455	10.8				194	6.1

Note. SD= Standard deviation.

Supplement Table 4.

Zero-order Correlations Between the Study Variables in the Imputed Sample (n = 4,703)

Measures		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
1.	Age																		
2.	Gender	.02																	
3.	Income	-.19	.11																
4.	Occupational status	-.46	.08	.52															
5.	Education	-.32	.06	.46	.50														
6.	Verbal IQ	.12	-.02	.32	.21	.42													
7.	Common mental disorders	-.10	-.09	-.12	-.06	-.07	-.08												
8.	Suicidal thoughts	-.12	-.05	-.07	-.01	.00	-.01	.35											
9.	Suicidal attempts	-.08	-.05	-.11	-.06	-.04	-.05	.24	.51										
10.	Problematic eating	-.16	-.10	-.02	.03	.03	-.04	.22	.18	.14									
11.	Borderline personality	-.09	.02	-.06	-.02	-.01	-.04	.20	.24	.25	.14								
12.	Antisocial personality	-.07	.06	-.05	-.03	-.02	-.04	.12	.15	.17	.05	.47							
13.	PTSD	-.08	-.03	-.07	-.02	-.01	-.04	.29	.22	.18	.13	.15	.09						
14.	ADHD	-.11	.01	-.07	-.03	.-02	-.04	.31	.23	.16	.14	.19	.11	.21					
15.	Hazardous drinking	-.18	.21	.10	.11	.07	-.02	.06	.08	.06	.06	.10	.11	.06	.10				
16.	Drug dependency	-.16	.05	-.08	-.02	-.01	-.07	.11	.14	.12	.05	.17	.21	.09	.11	.14			
17.	Gambling	-.02	.05	-.04	-.01	-.02	-.07	.05	.06	.05	.04	.05	.06	.05	.07	.04	.06		
18.	Smoking	-.18	.01	-.13	-.04	-.12	-.16	.13	.15	.16	.05	.11	.11	.08	.09	.15	.20	.03	
19.	Treatment utilization	-.00	-.08	-.10	-.08	-.05	-.03	.29	.26	.20	.10	.13	.07	.15	.17	.01	.08	.06	.07

The correlations of ≥ |0.05| are statistically significant at $p<0.01$ (except between treatment utilization and hazardous drinking, where $p=.96$), and ≥ |0.03| at $p<0.05$ (except between gambling and income ($p=.09$), problematic eating and occupation ($p=.16$), education and problematic eating ($p=10$), verbal IQ and PTSD ($p=.26$) and treatment utilization ($p=.10$), and gambling and drug dependency ($p=.09$).

Appendix B

Attrition Analysis

Supplement Table 5.
Summary of Logistic Regression Analyses Predicting Exclusion from the Study sample (n=4,707 vs. n=2,696, reference group =those included in the study sample)

	Model 1		
Variable	OR	95CI	*p*
Age	1.00	(1.00-1.00)	.20
Gender	0.93	(0.84-1.02)	.12
Education	**0.88**	**(0.85-0.91)**	**<.001**
Occupational status	**0.88**	**(0.86-0.90)**	**<.001**
Income	**0.77**	**(0.73-0.80)**	**<.001**
Verbal IQ	**0.99**	**(0.98-0.99)**	**<.001**
Common mental disorders	1.10	(0.97-1.25)	.15
Suicidal thoughts	0.88	(0.77-1.01)	.07
Suicidal attempts	0.91	(0.73-1.13)	.41
Problematic eating	1.06	(0.87-1.29)	.54
Borderline personality	**0.70**	**(0.51-0.95)**	**.02**
Antisocial personality	0.75	(0.45-1.19)	.23
PTSD	1.26	(0.96-1.66)	.10
ADHD	1.06	(0.89-1.26)	.52
Hazardous drinking	**0.77**	**(0.69-0.87)**	**<.001**
Drug dependency	1.12	(0.83-1.49)	.46
Gambling	1.35	(0.71-2.51)	.35
Smoking	0.91	(0.81-1.02)	.09
Treatment utilization	1.05	(0.89-1.24)	.55
	Model 2		
	OR	95CI	*p*
Education	0.93	(0.85-1.02)	.13
Occupation	1.04	(0.97-1.10)	.28
Income	**0.89**	**(0.81-0.98)**	**.01**
Verbal IQ	1.00	(0.99-1.01)	.94
Borderline personality	**1.57**	**(1.02-2.71)**	**.03**
Hazardous drinking	0.83	(0.63-1.07)	.16

Note. In model 1 all variables were entered separately while the model 2 includes all the significant variables from model 1 entered at the same time. OR= Odds Ratio, 95CI= 95% confidence interval.

Appendix C

The structure of psychopathology

Supplement Table 6.
Summary of Confirmatory Factor Analysis for the p-factor using Weighted Least Squares Mean and Variance Adjusted Estimator from the Study Sample (n=4,707)

	β	B	SE
Common mental disorders	.73	1.00	
Suicidal thoughts	.86	1.18	0.04
Suicidal attempts	.91	1.24	0.04
Problematic eating	.50	0.68	0.04
Borderline personality	.84	1.14	0.04
Antisocial personality	.87	1.19	0.05
PTSD	.69	0.94	0.05
ADHD	.62	0.84	0.04
Hazardous drinking	.24	0.32	0.04
Drug dependency	.55	0.75	0.06
Gambling	.40	0.55	0.10
Smoking	.40	0.55	0.04

Note. β=standardized factor loading, B= Factor loading, SE=standard error.

Supplement Table 7.
Summary of Confirmatory Factor Analysis for the p-factor using Weighted Least Squares Mean and Variance Adjusted Estimator from the Imputed Sample (n=7,403)

	β	B	SE
Common mental disorders	0.72	1.00	
Suicidal thoughts	0.87	1.21	0.03
Suicidal attempts	0.90	1.25	0.03
Problematic eating	0.50	0.69	0.04
Borderline personality	0.82	1.14	0.03
Antisocial personality	0.87	1.21	0.04
PTSD	0.70	0.98	0.04
ADHD	0.63	0.88	0.03
Alcohol Consumption	0.30	0.41	0.03
Drug dependency	0.58	0.81	0.05
Gambling	0.40	0.56	0.09
Smoking	0.42	0.58	0.03

Note. β=standardized factor loading, B= Factor loading, SE=standard error.

Supplement Table 8.

Summary of Confirmatory Factor Analysis for the Two-factor Model using Weighted Least Squares Mean and Variance Adjusted Estimator from the Imputed Sample (n=7,403)

	β	B	SE
Internalization			
Common mental disorders	0.75	1.00	
Suicidal thoughts	0.89	1.20	0.03
Suicidal attempts	0.92	1.23	0.03
Problematic eating	0.52	0.69	0.04
PTSD	0.73	0.97	0.04
Externalization			
Borderline personality	0.90	1.00	
Antisocial personality	0.91	1.01	0.04
ADHD	0.71	0.79	0.03
Alcohol Consumption	0.35	0.39	0.03
Drug dependency	0.66	0.73	0.04
Gambling	0.45	0.50	0.08
Smoking	0.48	0.53	0.03

Note. β=standardized factor loading, B= Factor loading, SE=standard error.

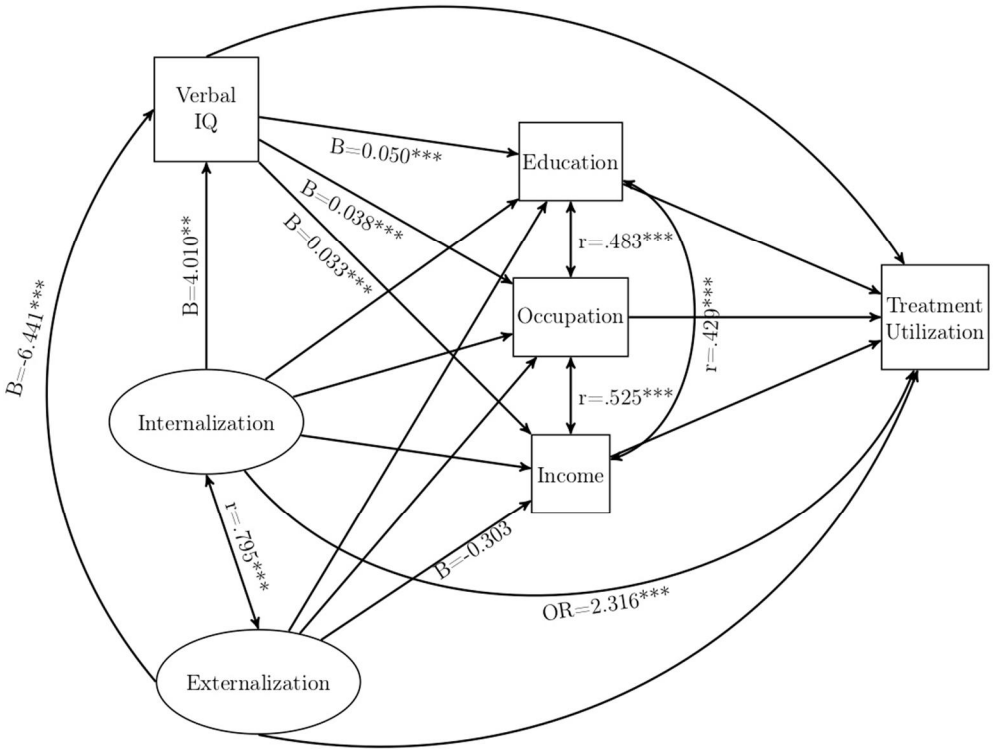
Supplement Table 9.

Summary of Confirmatory Factor Analysis for the Two-factor Model using Weighted Least Squares Mean and Variance Adjusted Estimator with the Imputed Sample (females n=4,206, males n= 3,197)

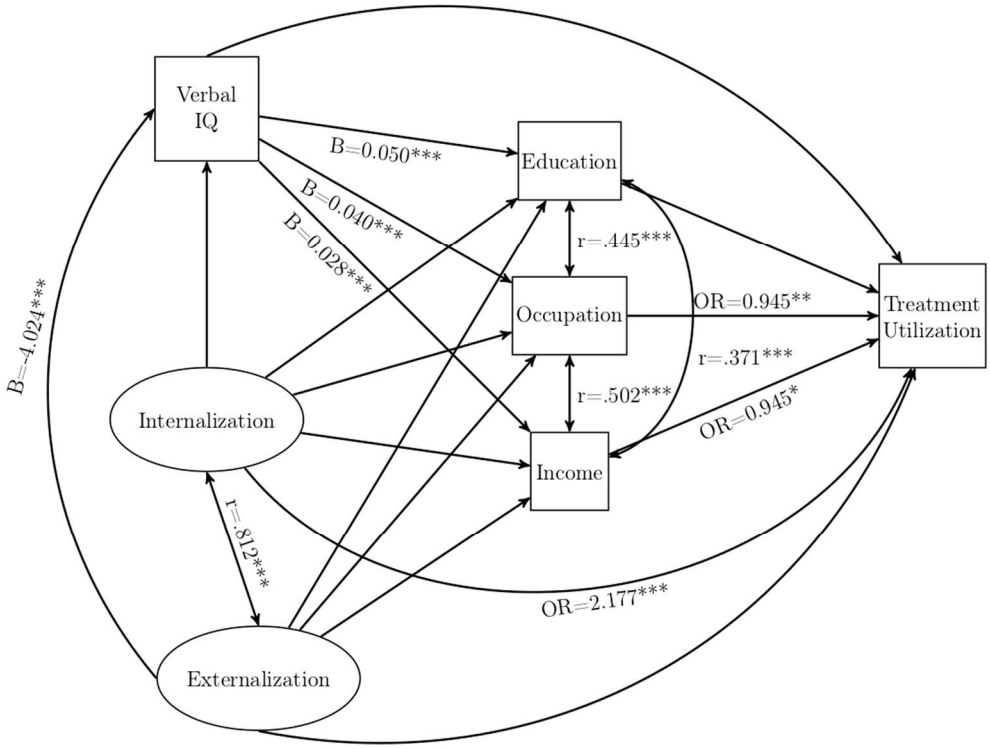
	Female			Male		
	β	B	SE	β	B	SE
Internalization						
Common mental disorders	0.72	1.00		0.79	1.00	
Suicidal thoughts	0.90	1.25	0.04	0.87	1.11	0.04
Suicidal attempts	0.92	1.27	0.04	0.91	1.16	0.05
Problematic eating	0.55	0.76	0.04	0.48	0.63	0.06
PTSD	0.69	0.95	0.05	0.79	1.00	0.06
Externalization						
Borderline personality	0.84	1.00		0.92	1.00	
Antisocial personality	0.87	1.03	0.07	0.93	1.00	0.05
ADHD	0.70	0.83	0.05	0.70	0.76	0.04
Hazardous drinking	0.38	0.46	0.04	0.35	0.38	0.04
Drug dependency	0.57	0.67	0.06	0.71	0.77	0.05
Gambling	0.36	0.42	0.07	0.49	0.53	0.09
Smoking	0.43	0.50	0.04	0.52	0.56	0.04

Note. Correlations between the factors were r=. 80, p<.001, and r=.78, p<.001, with females and males, respectively. β=standardized factor loading, B= Factor loading, SE=standard error.

Appendix D



Supplement Figure 1. The results from the SEM model 3 with the female sample. Latent variable indicators, statistics of non-significant associations, and errors omitted. The association between externalization and income was close to statistical significance (p=.052).



Supplement Figure 2. The results from the SEM model 3 with the male sample. Latent variable indicators, statistics of non-significant associations, and errors omitted.

Supplement Table 10.

Individual Regression Associations from the Structural Equation Model 1 with Internalization with the Imputed Sample (all fitted at the same time)

	Female (n=4,206)					Male (n=3,197)				
Treatment utilization	OR	95%CI	β	*p*	R^2=.321	OR	95%CI	β	*p*	R^2=.464
Education	1.008	(0.965-1.052)	-.008	.860		1.026	(0.975-1.080)	.025	.618	
Income	1.023	(1.015-1.063)	-.023	.537		0.970	(0.935-1.007)	-.030	.425	
Occupational status	**0.851**	**(0.815-0.900)**	**-.159**	**<.001**		**0.859**	**(0.821-0.900)**	**-.151**	**.001**	
Internalization	**2.181**	**(2.088-2.280)**	**.553**	**<.001**		**2.280**	**(2.168-2.400)**	**.645**	**<.001**	
Verbal IQ	1.001	(1.999-1.003)	.016	.580		1.003	(1.000-1.006)	.037	.304	
Education	B	SE	β	*p*	R^2=.188	B	SE	β	*p*	R^2=.223
Internalization	0.038	0.032	.027	.231		0.019	0.035	.015	.589	
Verbal IQ	**0.034**	**0.001**	**.436**	**<.001**		**0.034**	**0.001**	**.471**	**<.001**	
Occupational status	B	SE	β	*p*	R^2=.033	B	SE	β	*p*	R^2=.052
Internalization	-0.021	0.035	-.015	.548		**-0.121**	**0.038**	**-.096**	**.001**	
Verbal IQ	**0.014**	**0.001**	**.182**	**<.001**		**0.014**	**0.001**	**.197**	**<.001**	
Income	B	SE	β	*p*	R^2=.136	B	SE	β	*p*	R^2=.141
Internalization	**-0.182**	**0.030**	**.131**	**<.001**		**-0.244**	**0.032**	**-.194**	**<.001**	
Verbal IQ	**0.026**	**0.001**	**.331**	**<.001**		**0.022**	**0.001**	**.302**	**<.001**	
Verbal IQ	B	SE	β	*p*	R^2=.010	B	SE	β	*p*	R^2=.011
Internalization	**-1.807**	**0.395**	**-.101**	**<.001**		1.830	0.494	-.104	**<.001**	
Allowed covariances	COV	SE	r	*p*		COV	SE	r	*p*	
Education, income	**0.381**	**0.014**	**.455**	**<.001**		**0.344**	**0.015**	**.421**	**<.001**	
Education, occupation	**0.530**	**0.013**	**.598**	**<.001**		**0.473**	**0.015**	**.551**	**<.001**	
Income, occupation	**0.510**	**0.013**	**.557**	**<.001**		**0.497**	**0.014**	**.551**	**<.001**	

Note. Bolded variable names stand for the dependent variable (Treatment utilization, education, occupational status, income, and verbal IQ, respectively). All associations were fitted simultaneously. OR= Odds Ratio, CI= Confidence Interval, B=unstandardized estimate, SE=standard error, β=standardized estimate, COV=covariance, r=correlation.

Supplement Table 11.

Individual Regression Associations from the Structural Equation Model 2 with Externalization with the Imputed Sample (all fitted at the same time)

	Female (n=4,206)					Male (n=3,197)				
Treatment utilization	OR	95%CI	β	*p*	R^2=.174	OR	95%CI	β	*p*	R^2=.309
Education	1.025	(0.978-1.075)	.025	.594		1.051	(0.997-1.108)	.049	.347	
Income	1.019	(0.976-1.064)	.018	.660		0.951	(0-913-0.991)	-.049	.231	
Occupational status	**0.831**	**(0.792-0.872)**	**-.182**	**<.001**		**0.807**	**(0.768-0.849)**	**-.209**	**<.001**	
Externalization	**1.694**	**(1.586-1.809)**	**.410**	**<.001**		**1.758**	**(1.665-1.855)**	**.497**	**<.001**	
Verbal IQ	**1.005**	**(1.002-1.008)**	**.066**	**.041**		1.005	(1.002-1.008)	.071	.061	
Education	B	SE	β	*p*	R^2=.188	B	SE	β	*p*	R^2=.209
Externalization	0.040	0.040	.032	.311		-0.005	0.033	-.005	.878	
Verbal IQ	**0.034**	**0.001**	**.441**	**<.001**		**0.034**	**0.001**	**.473**	**<.001**	
Occupational status	B	SE	β	*p*	R^2=.037	B	SE	β	*p*	R^2=.074
Externalization	**-0.086**	**0.044**	**-.068**	**.050**		0.007	0.038	-.006	.852	
Verbal IQ	**0.015**	**0.001**	**.198**	**<.001**		**0.015**	**0.001**	**.206**	**<.001**	
Income	B	SE	β	*p*	R^2=.143	B	SE	β	*p*	R^2=.123
Externalization	**-0.203**	**0.037**	**-.161**	**<.001**		**-0.189**	**0.030**	**-.169**	**<.001**	
Verbal IQ	**0.024**	**0.001**	**.302**	**<.001**		**0.021**	**0.001**	**.291**	**<.001**	
Verbal IQ	B	SE	β	*p*	R^2=.068	B	SE	β	*p*	R^2=.038
Externalization	**-4.239**	**0.498**	**-.262**	**<.001**		**-2.963**	**0.454**	**-.189**	**<.001**	
Allowed covariances	COV	SE	r	*p*		COV	SE	r	*p*	
Education, income	**0.382**	**0.014**	**.458**	**<.001**		**0.347**	**0.015**	**.423**	**<.001**	
Education, occupation	**0.528**	**0.013**	**.598**	**<.001**		**0.475**	**0.014**	**.550**	**<.001**	
Income, occupation	**0.518**	**0.013**	**.570**	**<.001**		**0.514**	**0.105**	**.564**	**<.001**	

Note. Bolded variable names stand for the dependent variable (Treatment utilization, education, occupational status, income, and verbal IQ, respectively). All associations were fitted simultaneously. OR= Odds Ratio, CI= Confidence Interval, B=unstandardized estimate, SE=standard error, β=standardized estimate, COV=covariance, r=correlation.

Supplement Table 12.

Individual Regression Associations from the Structural Equation Model 3 with the Imputed Sample (all fitted at the same time)

	Female (n=4,206)					Male (n=3,197)				
Treatment utilization	OR	95%CI	β	*p*	R^2=.320	OR	95%CI	β	*p*	R^2=.462
Education	1.008	(0.964-1.054)	.008	.859		1.025	(0.974-1.079)	.025	.623	
Income	1.015	(0.966-1.057)	.015	.699		0.969	(0.932-1.006)	-.032	.399	
Occupation	**0.858**	**(0.820-0.899)**	**-.151**	**.001**		**0.862**	**(0.827-0.904)**	**-.148**	**.002**	
Externalization	0.922	(0.807-1.054)	-.066	.549		0.993	(0.893-1.104)	-.007	.945	
Internalization	**2.255**	**(1.978-2.570)**	**.602**	**<.001**		**2.241**	**(2.006-2.504)**	**.649**	**<.001**	
Verbal IQ	1.001	(0.998-1.004)	.007	.839		1.003	(1.000-1.006)	.037	.309	
Education	B	SE	β	*p*	R^2=.190	B	SE	β	*p*	R^2=.224
Externalization	0.085	0.100	.070	.851		0.042	0.076	.039	.574	
Internalization	-0.036	0.098	-.027	.710		-0.056	0.082	-.045	.496	
Verbal IQ	**0.035**	**0.001**	**.447**	**<.001**		**0.034**	**0.001**	**.475**	**.034**	
Occupational status	B	SE	β	*p*	R^2=.041	B	SE	β	*p*	R^2=.061
Externalization	0.189	0.112	.157	.091		**0.172**	**0.084**	**.158**	**.041**	
Internalization	-0.142	0.110	-.107	.194		**-0.268**	**0.092**	**-.217**	**.004**	
Verbal IQ	**0.016**	**0.002**	**.207**	**<.001**		**0.015**	**0.001**	**.213**	**<.001**	
Income	B	SE	β	*p*	R^2=.140	B	SE	β	*p*	R^2=.142
Externalization	-0.140	0.092	-.116	.128		-0.056	0.067	-.051	.408	
Internalization	-0.052	0.091	-.039	.571		**-0.189**	**0.075**	**-.154**	**.012**	
Verbal IQ	**0.024**	**0.001**	**.313**	**<.001**		**0.021**	**0.001**	**.297**	**<.001**	
Verbal IQ	B	SE	β	*p*	R^2=.079	B	SE	β	*p*	R^2=.037
Externalization	**-6.722**	**1.223**	**-.435**	**<.001**		**-3.922**	**1.03**	**-.258**	**<.001**	
Internalization	**4.229**	**1.273**	**.246**	**.001**		1.677	1.180	.097	.155	
	COV	SE	r	*p*		COV	SE	r	*p*	
Education, income	**0.384**	**0.014**	**.460**	**<.001**		**0.344**	**0.015**	**.422**	**<.001**	
Education, occupation	**0.526**	**0.014**	**.597**	**<.001**		**0.471**	**0.015**	**.552**	**<.001**	
Income, occupation	**0.516**	**0.013**	**.568**	**<.001**		**0.500**	**0.015**	**.557**	**<.001**	
External, internalization	**0.498**	**0.027**	**.799**	**<.001**		**0.585**	**0.030**	**.781**	**<.001**	

Note. Bolded variable names stand for the dependent variable (Treatment utilization, education, occupational status, income, and verbal IQ, respectively). All associations were fitted simultaneously. OR= Odds Ratio, CI= Confidence Interval, B=unstandardized estimate, SE=standard error, β=standardized estimate, COV=covariance, r=correlation.